THE

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ELECTRICAL REVIEW.

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STANDARDISATION OF COOKING AND HEATING APPARATUS.

AMONGST the various matters of interest which claimed attention at the recent meeting of the Point Fives, we notice that the Chairman's suggestion that the simpler class of cooker could now be practically standardised, to facilitate manufacturing in quantity and reduction in selling cost, met with little response.

Any suggestion of this sort usually meets—as this did—with the reply that the time is not ripe for such a move, as improvements are constantly being introduced, and so on; and there the matter ends for the time.

But let us face the facts. Those blissful conditions of domestic life in which the electric cooker is to play such an ambitious *rôle* will never be attained while electric cooking apparatus is beyond the means of the average householder—"point five" tariffs notwithstanding—and we must admit that the technical advantages likely to be derived by allowing the designer of apparatus absolute freedom in his efforts will not necessarily be translated into commensurate economies in manufacturing, with which we are mainly concerned.

We are reminded that some meritorious inventions might never have seen the light of day, had not the ruthless commercial man cut short the process of perfection on which the inventor was engaged and applied his ideas then and there to some practical purpose, and we fail to see why the electricity consumer of to-day should be denied the benefits of organised production in order to provide future generations with a more perfect edition of what is already an efficient apparatus.

At the present time each manufacturer standardises his own products, as far as possible, apparently without prejudicing experimental development, and what is required on the part of the central-station authorities and manufacturers is some agreement fixing standard lines of development, and standard dimensions and ratings, and aiming at some degree of interchangeability of parts.

This is obviously a matter in which the Point Fives could set the ball rolling, and which the recently-formed Electrical Development Committee of the I.M.E.A. could investigate through a technical sub-committee, with a view to presenting a report for discussion at the annual convention. Such a report, if it only reviewed the position at the moment, would be instructive and, no doubt, would lead to some explanation of the considerable divergencies in design which at present exist.

Take, for instance, the following data for what we may call—only from the resemblance in outward shape—"gas-stove" type electric ovens by four well-known makers. The cubical capacities of the ovens, which are apparently intended for cooking for an "ordinary household," vary from 5,500 cb. in. down to 3,600 cb. in., while the maximum loadings

are ·54, ·59, ·44 and ·66 watt per cb. in., from large to small size. Another widely used oven of a different type, of 4,250 cb. in. capacity, has a maximum loading of only ·37 watt per cb. in.

In the matter of boiling plates makers are equally at variance, a few lists showing 7-in. plates with loadings of from 800 to 1,000 watts, and 8-in. plates with loadings of from 800 to 1,200 watts (each individual maker having his own rating for each diameter), while a glance at the particulars of hot-water urns leads to the assumption that some makers are prodigal in their ratings, or that the others possess the secret of efficiency to an extraordinary degree.

Making allowance for certain technical differences, which can be readily explained, there still appears to be scope for some standard lines of development along which the ingenuity of the designer should be directed for preference, at the earliest possible moment. It is fair to assume that the electric cooker will be placed in the hands of neither more nor less skilful users than is the case with the gas cooker, and that the latter gives a reasonable degree of satisfaction will be granted, despite the filthy conditions which often prevail, and discount any approach to the efficiency in use which the designer presumably intended. The only efficiency which counts is that obtained by the user, and progress in this respect is only deferred, so long as the apparatus is generally out of reach.

Engineers and the Technical Press.

The greatness of Manchester as an engineering centre is unquestionable, and in consequence it has good reason to be proud of the large army of engineers of all kinds who follow their callings in the district. And Manchester being smaller and more compact than London, and possessing a frequent and convenient tramway system, which takes you in from the outer manufacturing districts right to the heart of the city where hotels and other such public meeting places are to be found, its engineers, both professional and trade, have succeeded in establishing a very useful institution known as the Engineers' Club. Here excellent opportunities are afforded for social intercourse, for "talking shop," and for comparing views on engineering matters of the moment. Amid such surroundings it is possible to conduct proceedings with greater freedom and less formality than would be considered becoming at a full-dress discussion at a dignified institution. But even at an Engineers' Club if you want a successful gathering there must be a good subject and an author who, by practical experience, is able to deal with it authoritatively. The Manchester Club is not confined to technical engineering matters, indeed sometimes it aspires to scale the heights to far loftier regions. It has comparatively recently brought its weight to bear by discussing measures for giving a stimulus to the Board of Trade, so that it may represent engineering and other industry more worthily in these trade-capturing days and in the future when pruning hooks and ploughshares have succeeded to less peaceful contrivances. Of the Club in this connection we say more power to its elbow! Still more recently it has had a discussion on "The Engineering Trade and the Press." Unfortunately, when the Board of Trade was under fire every nail of criticism that was driven home must drive into that one Board—it could not point to any other culprit; but when the Press comes in for critical attention, everybody finds the cap to be—well, a misfit. Now, everybody who has not been on the Press knows perfectly well how it should be run, and it has not been unknown for the Press even to suggest measures for the more enterprising conduct of some branches of engineering industry. How far the engineer is capable of running the Press, and how far the Press is able to assist the engineer, would be a most excellent subject for a Club debate. Our own view, after having had something more than an average experience in both capacities, is that their functions and operations are mutual and co-operative. The technical Press depends upon the engineering employer because he is an advertiser, and upon the professional engineer because he is a reader, and very often a most acceptable writer. The engineering employer and professional engineer alike depend upon the technical Press, because it informs them upon many matters, tells them of developments that will bring them business, and if they advertise takes their names to the uttermost parts of the earth—if it goes there. Now seeing that the Press has ventured to make suggestions to the engineer, nothing is more natural than for the engineer to desire to assist the Press to increase its own efficiency. Whereat we, of all Editors, shall be the last to take offence. Indeed, we welcome any movement that engineers and the engineering trade may think fit to institute, for inquiring as to which out of the scores of journals published in these days of trade-expansion efforts meet their requirements most satisfactorily. Where there are large families there may not be so much to go round as where there is one petulant spoilt child, unfettered, and licensed to go its own way, but there may be a spirit of self-help and independence engendered by sheer necessity. It may be so in respect of the Press. There may be a large family, but only the members that are able to give evidence of proved ability to assist profession and industry are allowed to survive for any length of time, unless manufacturers and traders, the while they grumble because there are so many of us, open their hand with indiscriminate generosity. When the Manchester Engineers' Club held its discussion a week or two ago, it was fortunate in having as the opener of its debate, Mr. Frank Nasmith, editor of the *Textile Recorder*. We congratulate the club upon having such a high standard of journalistic practice put before it, and the author upon having the courage to express his views. As a general rule, we prefer to let our pages speak for themselves concerning the store of valuable material that very carefully considered and very definitely adopted policies lead us to publish; we also prefer, on the whole, to let manufacturers' own correspondence and order books tell them where our Review circulates regularly every week—not once now and again when the fit takes us. But it is as well that occasionally an editor should meet the representatives of the industry as Mr. Nasmith did at Manchester, and bring before their notice how much they owe to the technical Press when it carries on its operations in such a way as to win the life-long attachment of its readers by publishing the information that they require but can obtain in no other way, and by exercising a spirit of independence and fairness in maintaining a high standard of editorial policy.

Lead.

There has been a very satisfactory business done in lead during the last few weeks, and while there has not been any elasticity shown in prices, there has nevertheless been a steady tone in the market. Much of the selling witnessed came from agents for the Convention who, at times, appeared anxious to keep down the price, probably in order to prevent America getting a fresh foothold here. American lead has on more than one recent occasion proved a bugbear, and the leading interests here have an antipathy to material being offered from across the Atlantic because it spoils their market.

There has been a good deal of metal coming to hand from abroad, and this has resulted in the market being pretty well supplied with material. The natural sequence to this is that there has been a weakening in the price of spot and

early delivery material compared with forward, but the discount does not amount to much, though the fact that there is a discount is worth recording. For the most part everything which is coming forward appears to be wanted, but there has been a falling off in the demands met with from Russia, which country has for a long time now been one of the mainstays of the lead position. Not only have considerable quantities of lead been shipped from England to Archangel, and also from Australia direct to Vladivostock, but sales have also been made for shipment from New York to the latter port. Attempts have been made also to ship direct from Spain, but the shipping difficulty seems to have proved insuperable in this case. With the approach of the spring it is to be expected that the Vladivostock route will lapse into disfavour, because Archangel is much handier.

The main consumption in progress is undoubtedly in connection with the supplies of ammunition required by the forces in the field, and the demands experienced on this account can hardly undergo any important abatement for some months to come, or at least until the war has entered upon a new phase. There is considerable dislocation still in the Broken Hill region of Australia, but taken all round output appears to be quite sufficient for all practical purposes. Mines and smelters are partially at work and under the restrictive conditions affecting general consumption as distinguished from consumption for war purposes, there is apparently plenty of lead available.

The position in North America is rather uncertain. For one thing the remarkable advance in the price of spelter has put this metal into an altogether false relation to lead, and this tends to have an unsettling effect upon markets, while in Mexico chaos continues to reign undisturbed. It is quite possible that if only the congestion at the docks abated and lead were to be got out of arriving steamers with something approaching reasonable expedition, there might be a small further reduction in the price of early deliveries, but so long as congestion reigns undisputed, something near to-day's level of prices seems likely to be continued, always supposing that no unforeseen new factor comes into play.

The International Aluminium Industry.

A SCHEME is being promoted in Germany for the purpose of rendering that country independent, if possible, of the quotations for various metals which are given on the London Metal Exchange, on the return of normal conditions after the conclusion of the war. A subsidiary exchange for copper has already been in existence for two or three years in connection with the Berlin and Hamburg Stock Exchanges, and the Exchange Committee of the former has now been asked to extend the scope so as to include quotations and contracts for spelter, lead, aluminium, and antimony. The question as it affects the four metals has been set forth in a memorandum, an extract from which, concerning aluminium alone, may, perhaps, be of interest. As is well known, an international aluminium convention or syndicate was in existence down to the outbreak of the war. The sole object of the syndicate was to regulate the production of the works and prescribe minimum prices, and, in the absence of a sales organisation, the business with consumers was generally conducted through a number of merchants. According to the experience gained in recent years, the price which consumers have had to pay has differed in many cases from the particular charge which was fixed by the syndicate. During periods of great demand the merchant price has rapidly risen above the syndicate minimum, but at other times, when large quantities of aluminium have been in the possession of the merchants, the prices actually realised by the latter have been much below those of the syndicate, so that it may be said that the actual course of prices has been probably influenced on wide lines by the syndicate, although not settled individually by the combination. The world's production of the metal increased from 8,200 tons in 1903 to 68,200 tons in 1913, and a further large augmentation is expected in the future. The memorandum states that this fact, taken in conjunction with the circumstance that next to the United States Germany has the largest consumption, renders it desirable that the latter country should secure the important position in the world's market to which it is entitled, by the establishment of a German Exchange. The idea is that by the creation of such an exchange aluminium could be delivered both as original works' material and as remelted metal; the former in ingots, bars, and sheets, and the latter in ingots, having a percentage of from 98 to 99 per cent. of pure metal. It is further suggested that in addition to Berlin the places of delivery should be Hamburg, Rotterdam, and Antwerp, and that a reduction of 5s. per cwt. in the contract price should be made for remelted material. As the aluminium works have always concluded long term contracts and have granted to purchasers the right of calling for delivery in from six to eight weeks, it is proposed that the quotations on the exchange should be for one particular month and the 11 succeeding months. As bearing on the present situation of the international market, Norwegian newspapers report that a company at Stavangar recently purchased aluminium in the United States of the value of £54,000 owing to the European market being closed. In Norway itself the productive capacity is undergoing a great expansion. The Anglo-Norwegian Aluminium Co., for instance, is credited with having now completed its works at Vennersla, where 2,000 tons per annum are to be made; a second company, having French working capital, is said to have acquired the undertaking of the Hardanger Electrical Iron and Steel Co. for the purpose of constructing cables of aluminium, and the Norwegian Nitrite Co., of Eydehavn, is also declared to have erected a large works for the output of the metal.

The Swiss Electrical Industry.

A FURTHER contribution on the subject of the situation of the electrical industry in Switzerland is contained in the December issue of the publication issued by the Swiss Credit Anstalt. The report states that during the first half of 1914 the industry was very well employed, and also had an abundance of orders in all branches at the close of June. Despite the complaints which were being made at that time in various countries as to the course of business, it was confidently expected in Switzerland that the results for the electrical industry would be favourable for the whole of 1914, but every estimate was upset by the outbreak of the war. It has to be borne in mind that Swiss firms have to depend upon the export trade for the greater portion of their business; the inland market alone could not have kept them employed even if trade in Switzerland had not experienced a decline through the war. On the outbreak of hostilities the foreign trade was at first completely tied up, and at the present time it can in no way be foreseen when, and to what extent, a revival will probably take place. The demand on the part of different countries has undergone a very material shrinkage, apart from the many obstacles in the way of transport to destinations, whilst the collection of payments from abroad is a matter of greatest difficulty. There is also uncertainty as to whether or not the Swiss industry will be brought gradually to a complete standstill owing to the hindrances to securing the delivery of raw materials, and considering the whole of the facts, the report concludes that the only course is to await developments.

Electrolytic Production of Oxygen.—Several factories in St. Louis, Mo., are now engaged in the electrolytic production of commercial oxygen gas. The electrolyte used is a 10 or 15 per cent. solution of either caustic soda or caustic potash. The oxygen given off at one electrode is collected and compressed, while the hydrogen given off at the other electrode is allowed to escape.—*Chemical Trade Journal.*

D

MODERN WIRING WORK, PARTICULARLY IN BAD SITUATIONS.

By H. C. TOFIELD.

(*Continued from page* 169.)

An installation carried out with C.T.S. wires is not intended to compete with thin, close-joint, slip-conduit and foreign V.I.R. cable. Cheap conduit installations frequently entail considerable expense in repairs owing to subsequent breakdowns after being installed a short time, while the use of slip conduit is prohibited under the rules of the Institution of Electrical Engineers, by the Fire Insurance Companies and a large number of Supply Authorities.

Where a system of wiring is to be installed in a wet or corrosive situation and is expected to successfully withstand these conditions, the best material must be used, and cost is not usually such an important point as the provision of a first rate job. In fact, cost is often taken as the most unimportant item in a first rate job, such as where one occasionally finds contractors who have been given the maintenance charge of jobs in severe situations, as acid factories, but prefer to stick to other systems of wiring, however useless they have been proved, so long as they can say the consulting engineer specified it originally. It is difficult to imagine what is the reason for such conservatism, but it is quite clear that a maintenance job is a *very* useful one in slack times.

It is in such cases as these that the C.T.S. wiring system has its special advantages over any other method of wiring, for it will provide a satisfactory installation under most circumstances with a minimum expenditure.

The best insulated wires are of little value in bad situations if the fittings do not protect the ends of same as efficiently as the wires themselves are sheathed, and in order that they shall be fully protected, several fittings have been specially designed for corrosive situations as previously mentioned, and some further details of these may now be given in conjunction with the classes of work dealt with.

The types of buildings usually met with in which it is proposed to instal electric light or power may be divided into three classes, in much the same way as the fire insurance companies differentiate between "hazardous" and "non-hazardous" risks.

Where the installation would be called upon to carry out its functions under severe conditions, it might be termed a "hazardous" risk (see Class "A" below) not of course from the fire insurance point of view, but from the fact that the wiring would be more liable to breakdown, and therefore, extra precautions would have to be taken in carrying out the wiring of the installation and in the choice of accessories, while in cases where conditions were normal (as in Class "C") a thoroughly satisfactory job could be provided with the type of accessories commonly met with. From which it will be seen that while C.T.S. wires are of the same quality in all cases, different types of fittings must be used for various classes of installations in order to suitably protect the ends of the wires according to the positions in which they may be installed. The different types of installations may be divided as follows:—

Class "A."—All buildings such as chemical works, salt works, dye works, powder works and magazines, bleach works, paper mills, tanneries, soap works, oil and petrol stores, bacon factories, laundries, baths, washhouses, cold stores, breweries, stables, jetties, also workshops and factories where damp or corrosive conditions exist, and rolling mills, collieries, and other places where fittings would be subject to mechanical damage in addition to corrosive action.

Class "B."—All new buildings in ferro-concrete or brick and unplastered, where the wiring is to be concealed throughout and wires sunk in walls and ceilings ready for making good. All ceiling fittings, switches, distribution boards, &c., to be fixed when the decorations are completed.

Class "C."—Private houses of every description, banks, offices, shops and all similar places in which it is desired that the wires shall be concealed throughout, or partly or wholly run on the surface as occasion may demand. All workshops and factories which are clean and dry, the wires being run on the surface of the walls and ceilings.

Cables.—The types of C.T.S. cable obtainable for wiring are as follows:—

Single-core circular.—This is suitable for all classes of concealed wiring and for surface wiring.

Twin or multicore circular.—This is also suitable for Classes "A," "B" and "C," and particularly so for all long runs and for main and sub-main cables feeding distribution boards, also for laying direct in the ground, as for instance, for garage lighting supplied from house, or outbuildings from factory.

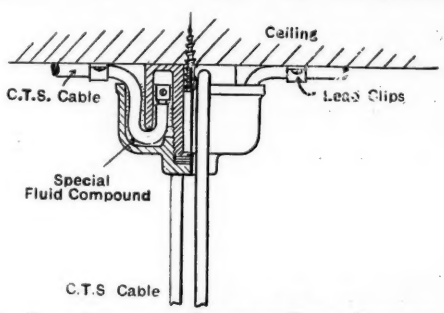


Fig. 1.—Part Section of Corrosion-Proof Junction Box.

Flat section twin and three-core.—This is most suitable for Class "C," also for surface wiring and concealed work in dry situations.

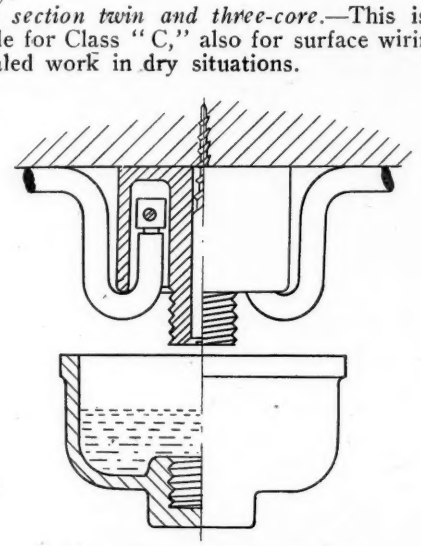


Fig. 2.—Parts of Junction Box.

Fittings.—Special fittings, such as junction-boxes, distribution boards, switches and lampholders are only required in connection with work carried out in places similar to those enumerated under Class "A."

For Class "B" all ordinary switches, distribution boards, &c., can be used.

For Class "C" a neat junction box is utilised, as it is invariably used in clean and dry situations. As twin flat and three core flat wires are employed under Class "C," the use of this box will obviate loops to switches, &c., and so considerably simplify the method of wiring and save expense. Any kind of switches, &c., may be used.

Corrosion proof fittings for Class "A." Ceiling type junction box (White's Patent).—This fitting is made of porcelain, and allows the cable ends to dip into the inner sealing chamber, divided by partitions to separate the poles. The chambers are filled with

a semi-liquid material of an insulating and waterproof nature so as to effectually keep out moisture and corrosive vapours or gases. (See figs. 1—3.)

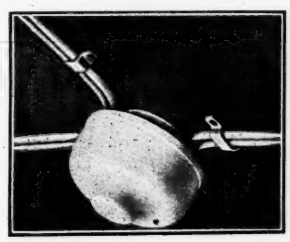


FIG. 3.—CEILING TYPE JUNCTION BOX IN POSITION.

The fitting is easily fixed, and by filling the outer cup with the sealing liquid before screwing it up, the whole is completely sealed. It forms either a two or three way connector box, and allows the ordinary "loop in system" to be carried out, while it also acts as a "ceiling rose" from which the C.T.S. leads are taken to the corrosion proof lampholder.

Wall type junction box (White's patent).—The method of sealing is on the same principle as the above, but the box is adapted for fixing on the wall.

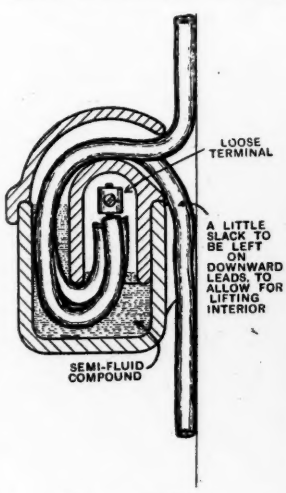


FIG. 4.—SECTION.

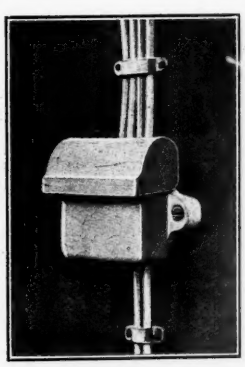


FIG. 5.—BOX IN POSITION.

WALL-TYPE JUNCTION BOX.

The leads, up to three per way, may be brought in or taken out in any direction. The downward leads must have a little slack allowed so that the interior may be lifted out when required.

(*To be concluded.*)

REVIEWS.

Motion Picture Operation: Stage Electrics and Illusions. By H. C. HORSTMAN and V. H. TOUSLEY. London: S. Rentell & Co. Price 8/6 net.

This is intended to be a practical handbook and guide to electricians employed in theatres, kinemas and stage illusion work, and the authors have attempted, with some measure of success, to compile a reference book which should contain as full information as possible relative to the matters with which such employés would come in contact. Where possible the authors have avoided the use of technical expressions, so that such non-technical men as managers and stage carpenters can readily understand the text. A slight working knowledge of electricity has naturally been assumed on the part of the reader, however, but there is no attempt to elaborate this, consequently the book is of a severely practical character. In it are two special chapters, "Portable Stage Equipment" and "Theatre Wiring," which have been arranged so as to be particularly valuable for reference, and the authors say that these chapters embody all the practical knowledge that has come to their notice during many years of actual experience with theatrical work.

In perusing these chapters, it has to be borne in mind that they were primarily written for American readers, and there are consequently terms and allusions which sound strange to English ears. Also there are a number of extracts from the National Electrical Code which are not likely to prove of any value to a reader in this country. Nevertheless, the chapters are full of information which is of value and should go far to improve the quality of the work carried out by stage hands who are not fully qualified electricians.

One of the features of the book is the number of diagrams given, but in connection with these it would be well to include new blocks in future editions, as several of those used have evidently seen much service. In fact, for an American publication, the illustrations, particularly the half-tones, are poor.

Perhaps the most useful part of the book is that devoted to the motion picture machine or bioscope. A number of types are described and illustrated, full and complete directions for working are given, and a special chapter is devoted to general hints on the installation, operation and care of machines. The book can be recommended to everyone engaged in the picture theatre business, although it is not so certain that it would be of great value to electricians engaged in the English theatre or music hall world.

G.B.B.

Electric Cooking, Heating, Cleaning, etc. By "HOUSEWIFE" (Maud Lancaster). Edited by E. W. Lancaster, M.I.E.E. London: Constable & Co. Price 3/6 net.

Under the above somewhat unwieldy and comprehensive title, a very useful and interesting compilation has recently been published. Though not particularly novel in its contents, it is still worthy of the attention of central-station engineers and all those interested in extending the use of electricity in the homes of the people. It serves both as a handy collection of various data and also as a book for recommendation to potential users of electricity for purposes other than lighting. Works of this nature are scarce, there being but two others which give anything like similar information—and one of these is written in the German language.

On the other hand it is not a book that would appeal to the average housewife. This is disappointing, for judging from the *nom de plume* of the writer one would expect some really practical information from the housekeeper's point of view. In style it is somewhat laborious and lacks freshness and vivacity.

If it is intended as a book of reference, the absence of an index largely militates against it. A full list of contents is given, but it is essentially clumsy and difficult of reference.

Approximately two-thirds of the book deals with electric cooking, and it is this portion which is the more masterly in treatment; the remainder is rather weakly tackled, apparently from the lack of practical knowledge on the part of the authoress and her editor. Of course there are comparatively very few persons who really have any extensive experience of domestic applications of electricity in other fields than lighting and cooking. An especially valuable feature of the early pages consists in a brief discussion of the scientific principles underlying the art of cooking—information concerning which is normally very difficult of access, for the usual cookery manual does not deal with this aspect. From this it is proved that *slow* cooking, at temperatures which are perfectly under control, is the ideal method. This, as it happens, is the distinctive characteristic of electric cooking. Thus the overwhelming advantages

in favour of electricity as a cooking agent are clearly substantiated in a manner that many of its advocates do not fully realise, otherwise they would make their case even stronger. If the ordinary housewife understood these principles, the introduction of cooking by electricity into the home would be far more rapid. However, notwithstanding the analysis of these principles, the authoress does not seem fully to comprehend the efficiency, economy, and general advantages of the so-called fire-less or stored-heat cooker. It is true that a number of examples are cited, but they are indiscriminately mixed up with ordinary electric ovens.

Descriptions are included of a bewildering list of electric cooking apparatus, but very little practical assistance of real value is given to help a novice in making a wise selection.

To find a "housewife" inditing a homily to central-station engineers is somewhat amusing; perhaps, however, this is due to the influence of the mere male editor, whose name in this capacity is associated with that of the authoress on the title page. Nevertheless, a good point is arrived at in the suggestion that every central-station engineer should equip his own house electrically, so that he at least may gain experience at first hand—if he won't do this his committee or his directors are to insist upon it.

For some unfathomable reason a selection of oven temperature curves is inserted in the middle, instead of at the beginning or the end, of the description of every oven concerning which the authoress could obtain particulars. One of these diagrams is particularly noteworthy, for it deals with the comparison of a bright unlagged sheet metal oven and a lagged oven—to the disadvantage of the former. This collection of graphs is interesting, for it is probably the first time that such a number has been published together, and some enlightening comparisons can be drawn from it. Of course all these diagrams emanate from a biased source, with no particulars as to how the temperatures were measured, and there is no more ticklish job than deciding what is the actual temperature of an oven. Further, any results are immediately upset when a joint is put into the oven.

Some thirty-eight pages are very wisely devoted to descriptions of large electric cooking installations in hotels and restaurants. This is the sort of thing that assists in convincing people as to the practicability of electric cooking, for if it pays commercially it must be within the reach of private persons. Moreover, such a section will be most useful when discussing the subject with architects and restaurant keepers, for so much in this country goes in accordance with precedent.

Some costs of cooking are interlarded with descriptions of electric cookers, and other particulars are sandwiched in after a discourse on domestic power applications. Though the authoress states that she has an electrically equipped home, she does not appear to draw as she might upon her own experience. If she had done so, it would have added much more to the value of the book, for after all, what everyone is looking for to-day is tangible practical records.

The heating of water and the warming of rooms are dealt with in the same characteristic catalogue style as in the case of electric ovens, and readers are left "to judge for themselves which method would best suit their individual requirements."

Again, electric vacuum cleaners receive their meed of attention, but here also practical pointers are lacking. For example, it might be anticipated that a reader would like to know under what circumstances a blower-type cleaner is preferable to a pump or bellows pattern.

As electrically driven washing machines are not yet employed to any extent in this country, the descriptions in this book of American appliances are well worth attention. The machines themselves are very much lighter in construction than the standard type of this country. Whereas the heavy English machine requires a 1-H.P. motor to drive it, the American pattern only needs ⅛ to ⅓ H.P. A mistake has been made in asserting that the cost of operation is 1d. per hour at 1d. per unit. By this would naturally be understood a 1-H.P. motor working at full load, whereas much smaller motors are fitted, as above stated. So much may also be gathered from an inspection of the illustrations.

An incorrect illustration has been inserted in the case of the "Magnet" electric iron (p. 275), which is one of the best on the market. However, no attempt is made to distinguish the qualities of any one iron from those of another.

The attempt to deal with domestic applications of power is somewhat futile. All the apparatus illustrated is only suitable for hotel or shop use, with the single exception of the Electric Maid-of-all-work, which is briefly referred to on page 282. The illustration which should accompany this is given on page 287. The authoress is apparently not aware of the Westinghouse utility motor, the Alexanderwerk equipment or the Electric Mary Ann. Undoubtedly the ultimate development for domestic uses will be along the lines of some such design. Certainly the average household will not be able to afford more than one or two electric motors.

The tables on pages 290 and 314 to 333 are rather striking examples of incompleteness.

In conclusion, the work is so much data without sufficient sequence. The beginning promises well, but its quality is not sustained, and the book has no conclusion. It lacks both originality and imagination throughout. As to the illustrations, they are generally overdone, often having little to do with the text, and sometimes not appearing to be fully comprehended by the authoress herself. They are all, with the exception of a few diagrams, very familiar to those who have had occasion to look at manufacturers' catalogues. Finally, the book is well got up, with clear type—though many of the blocks have seen use before, and the proof-reading has been done a little carelessly. But after all, one must not expect too much when 338 pages can be obtained for the sum of 3s. 6d., and certainly the book is worth this amount.

HALF-WATT LAMP FITTINGS.

By 'RESEARCH."

The restriction of lighting in so many towns has retarded the extensive use of half-watt lamps, but still they are getting increasingly popular. Whilst the design of the lamp itself leaves little room for improvement, this does not apply to most of the fittings supplied by the manufacturers. Dealing first with the lampholder, owing to the large current taken by the lamp the Edison screw cap was adopted. The lamp must be screwed up tight or otherwise there is heating, and ultimately arcing, taking place at the top contact. Now, in some types of fittings, the long stem of the lamp is pushed up through a small hole in the reflector, and the person screwing in the lamp cannot see what he is doing and must take hold of the bulb to screw the lamp by. The writer has known several lamps to be broken by the person thoughtlessly putting too much pressure on. Again, it has been found where lamps are suspended from tramway poles that vibration has caused the lamp to unscrew slightly, causing arcing at the top contact and the lamp to be welded to its holder.

Where the lamp is used for interior lighting, probably the best results are obtained with the indirect lighting system. It shields the eye from the glare, but an important advantage is that the lamp is freely exposed to the air and does not get too hot. The heat given off by these half-watt lamps is surprising, and when the lamp is enclosed in a

fitting and globe, ventilation becomes an important problem. For outside illumination the lamp must be completely protected from rain, as a drop of water on the globe, which is at a high temperature, cracks the glass at once.

The manufacturer of fittings must therefore aim at two things: first, protection from the weather; and, secondly, a very free circulation of air past the lamp to keep the temperature down. The second item is the most difficult, and some makers have treated it as of little importance. It is most important for several reasons. The lamp is not so likely to have a long life if the heat generated cannot escape. Any copper on the fitting is discoloured by the heat, and enamel or paint used for reflecting purposes is turned brownish, and therefore does not serve its purpose. Sweating takes place on the upper part of the fitting, and the drops of moisture formed have been known to drop on the lamp and crack the globe. The first cost of these lamps being unavoidably high, it is essential that every device should be adopted to enable them to last a long time. Moisture cannot be prevented from forming on the interior of the fitting, and therefore any such moisture should drain away from the glass of the lamp.

One other point that requires consideration is the position of the filament in relation to the reflector. In one type of fitting that the writer is acquainted with, the illumination is spoilt by the filament coming too far through the reflector. The ideal arrangement would be to have a lampholder so fitted that it could be raised or lowered as desired by simply slackening a screw. The best illuminating effect could be experimented with for a given height of pole, and all lamps similarly placed could then be adjusted in the same manner.

NOTES FROM CANADA.

[FROM OUR SPECIAL CORRESPONDENT.]

Reference has been made before in these notes to the growing tendency to employ underground cables in Canada. It has recently been announced that the town of Outremont, Quebec, has just installed a new lighting system which is fed throughout by underground cables; all the lamps are nitrogen filled, which makes the town unique in both respects. It is noticeable that the appearance of a number of busy streets in the heart of Toronto is steadily improving, due to the gradual removal of overhead wires, and the demand for underground construction is becoming more insistent in all the larger cities.

In Montreal the electrical companies, telephone, telegraph, tramways and lighting, are working together to form a "Safety First" league. The "Safety First" idea has "caught on" over here, and is being boomed in all quarters, not without good reason either, seeing the immense numbers of accidents which occur, most of them, of course, preventible with the exercise of a little care and foresight.

The Montreal Light, Heat and Power Co. are organising a section of the Home Guard and will supply the arms, &c. Most of the large firms here have acted similarly.

The City of Quebec is seeking power to raise a loan with which to buy out the Dorchester Electric Co., Quebec; the reported price is $1,000,000.

At St. John's, Quebec, the Canadian Hart Accumulator Co. has erected a plant and is now seeking orders for storage batteries.

Although there is a good deal of unemployment here many firms are being kept busy on large orders from home, though, unfortunately, there is not much in the electrical line. The Dominion Steel Co., in Sydney, N.S., is making large shipments of wire and rails, and is employing more than two-thirds of the full complement of men; several firms have received large orders for shrapnel shells.

The idea of municipal ownership is travelling far in these days; in Dawson City the authorities are considering the installation of municipal electric light and telephone plant which is estimated to cost about £33,000.

The Grand Trunk Pacific Railway has recently completed the telegraph connection between Winnipeg and Prince Rupert, B.C., the distance being about 1,279 miles; very many places, hitherto without, will now have the benefit of a telegraph service.

The Western Canada Power Co. is trying to arrange for the sale of $1,000,000 worth of bonds in England.

At Edmonton, Alberta, the Edmonton North-Western Radial Railway Co. want to run an inter-urban railway from the city to Pembina River.

Within the last few years a good deal of electrical equipment has been installed in Canadian mines; there is one, that of the Mountain Park Coal Co., situated about 200 miles from Edmonton, which is operated entirely by electricity. Rather more than 500 H.P. of generating plant is now in use.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

G.E.C. Extensible Swing Brackets.

The General Electric Co., Ltd., of 67, Queen Victoria Street, E.C., have sent us particulars of two new brackets which they have introduced recently. The bracket illustrated in fig. 1, which is the subject of a patent (No. 15,607/13), has an extension adjustable between 8 in. and 32 in., with a horizontal swivelling action within a semicircle; the angle of reflection is adjustable, as shown by the wing nut provided. By means of the curved extension of one of the arms of the lazy-tongs, the light can be raised

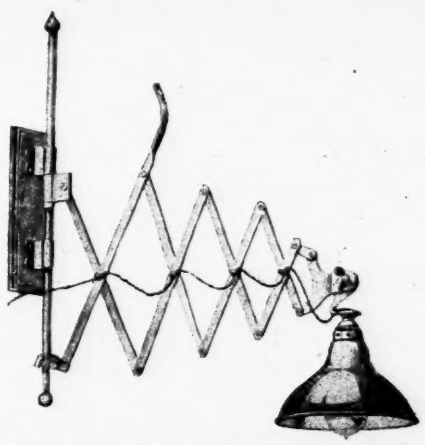


Fig. 1.—Lazy-Tongs Extensible Bracket.

to a fixed point 27 in. above the normal position. The fitting is made of polished brass, and is suitable for use in business offices, drawing offices, &c.

Fig. 2 shows a simple bracket (Patent No. 10,814/13), in which the horizontal arm is telescopic, giving a range for the lamp of from 24 in. to 42 in. By means of the wing nut connection for the lampholder and reflector the angle of reflection can be adjusted. The horizontal arm terminates in a tee-piece specially cut away in its lower half, so that the weight of the arm causes the

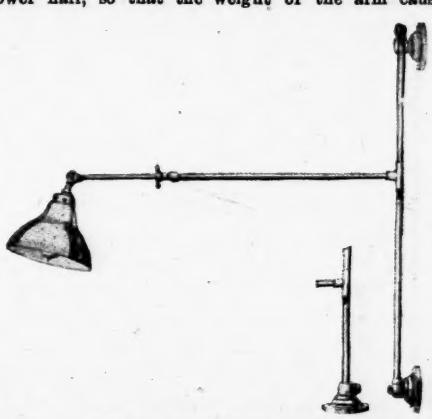


Fig. 2.—Telescopic Extensible Bracket.

tee-piece to grip firmly the upright on which it slides. No binding screws are required, and the arm can be moved instantly up or down or swung round in a vertical plane. Generally one wall plate only is necessary, but if the up and down travel desired is long, additional rigidity can be secured by the use of a top wall

plate. This bracket may also be used as a fixed standard by changing the position of the base-plate, as shown in the illustration. "Superlux" enamelled steel reflectors and Osram lamps are recommended for use with these brackets.

Ironclad Distribution Fuseboards.

Messrs. Siemens Brothers & Co., Ltd., Woolwich, have recently put on the market some fuseboards specially designed for power distribution purposes in large works where it is becoming general practice to use ordinary multicore lead-covered paper-insulated cables for motor and other circuits.

These boards are designed with detachable trifurcating boxes, which can be fitted either above or below the board. Each main fuse-box is arranged for two three-phase circuits and forms with

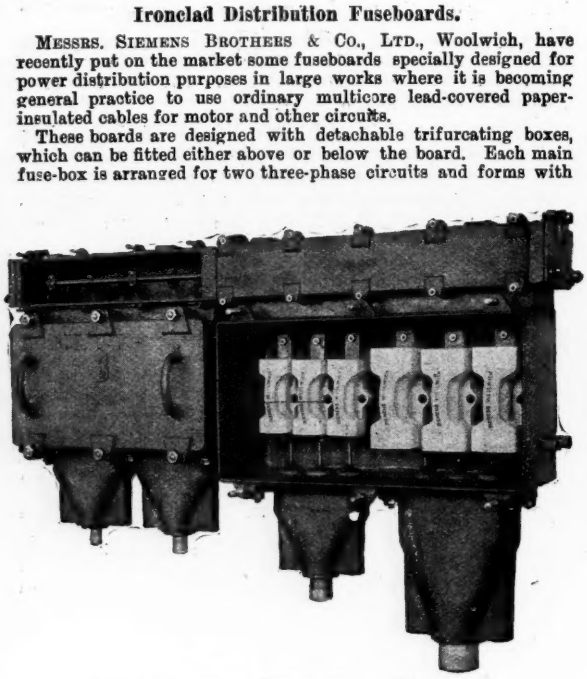


Fig. 3.—Ironclad Distribution Fuseboard.

its bus-bar chamber and dividing boxes a complete unit. The bus-bar chamber ends are covered with plates, the special feature of this arrangement being that additional sections can be added to either end, and extensions made at any time. The bus-bars are of copper tube and are also easily extended. The fuses are of the Home Office porcelain shrouded type, and liberally designed for contact area.

Details of these fuses are shown in the firm's catalogue No. 521, which will be sent on application.

"Presto" Hand-Lamp.

The Fuller Accumulator Co., Ltd., of Wick Lane, Bow, E., are placing on the market the "Presto" electric hand-lamp, which we illustrate in fig 4. This lamp has a neat parabolic nickel-plated reflector and a bull's-eye lens, and is fitted with a high

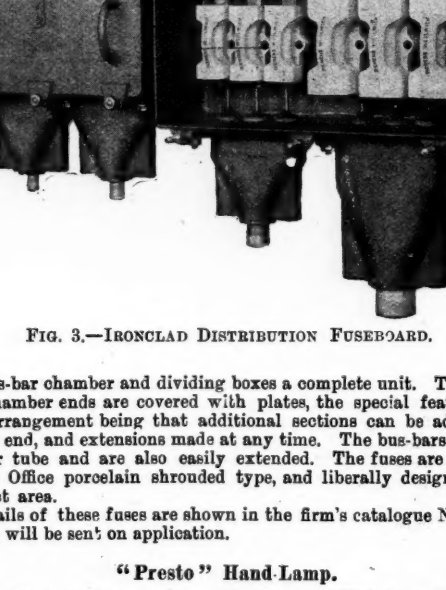


Fig. 4.—Types of "Presto" Hand Lamp.

efficiency metal-filament bulb, and attached by means of a swivel bracket to an ordinary dry cell or portable accumulator, as shown. A convenient carrying handle is provided, and a lamp switch at the back of the reflector. Lamp and dry cell complete weigh 5 ounces.

Simplex Radiators.

In a new electric heating list recently issued by Messrs. Simplex Conduits, Ltd., of 116, Charing Cross Road, W.C., a variety of luminous radiators and convectors is illustrated, the former having from one to six lamps. Fig. 5 shows a handsome pattern in gilt brass. A special feature of these radiators is the wiring between the switches and the lampholder, which is carried

Fig. 5.—Simplex Radiator.

to convenient screwed terminals in the base. The convectors operate on the Simplex strip system, the resistance ribbon being wound on mica plates, and the whole enclosed in a steel frame.

LEGAL.

Seear *v.* General Accessories Co., Ltd.

In the Shoreditch County Court on Thursday, before his Honour Judge Cluer, a custom of the trade was pleaded by a plaintiff, under peculiar circumstances. The plaintiff was Elwin Chas. Seear, trading as Messrs. Seear, Page & Co., London, E.C., agent for manufacturers of electrical accessories, and he sued the General Accessories Co., Ltd., London, E.C., manufacturers of electrical fittings, to recover £26 12s. 11d.

Mr. Hicks, barrister, appeared for the plaintiff, and Mr. R. S. Barnes was counsel for the defence.

Counsel explained that the order was for 100 gross of wooden blocks for electrical fittings. It was a custom of the trade to supply these in bags, when unfinished, but if finished in imitation walnut, teak, or white enamel, then they were in cases or boxes. Usually the unfinished sold at 5s. to. 5s. 6d. a gross, and the finished at from 7s. to 7s. 6d. At no time before the war were these sold at less than 6s. a gross, finished, and therefore defendants could not have imagined them finished at 5s. 3d. a gross.

Judge Cluer said at the moment he could not agree with that contention, as plaintiff was anxious to sell, as he sent out a circular to that effect, and the defendant might reasonably think he had got a bargain. The original circular of the plaintiff had the word "unfinished" in it, but a bad copyist had left that out. That might have been a mistake, but, taking himself as an example, he should have expected to get the finished article.

Mr. Hicks: My contention is, that if the defendants had not known positively at the time that they were unfinished they would have asked the colour. As to the circular, I know I have to stand by it, but bags are invoiced. I rely on that as a custom of the trade, and because no one in the trade would dream of getting the finished article at 5s. 3d., the price of these.

Judge Cluer said they were called "Round, recessed wood blocks," and in law that meant the finished article. What surprised him was that when a blunder had been made by a clerk the plaintiff chose to go to law about the matter.

Plaintiff, in his evidence, said that he had never sold at such a price as 5 . 3 l.

Judge Cluer said it was clear that a mistake had been made, and he would have taken them for finished himself. His verdict would be for the defendants, with costs.

The costs of expert witnesses, in the electrical trade, who were to have been called to prove the custom of the trade, were allowed to the defendants.

British Thomson-Houston Co., Ltd., *v.* Duram, Ltd.

In the Court of Appeal on February 4th, before Lords Justices Buckley and Pickford, the hearing of the plaintiffs' interlocutory appeal in this pending action against an order of Mr. Justice Neville for discovery took place. In the action the plaintiffs claim an injunction restraining the defendants or their servants from infringing the plaintiffs' Letters Patent No. 21,513* of 1906, and No. 17,722 of 1911; damages, or at plaintiffs' option, an account of profits, and the delivery up of articles or things made in infringement of the letters patent. The plaintiffs claim to be the regis-

tered legal owners of the letters patent for an invention of processes and apparatus for the treatment of metallic tungsten and for the manufacture of electric lamp filaments therefrom, and also of Letters Patent No. 17,722, granted to John Thomas Henry Dempster for improvements in methods of wire drawing.

The defendants do not admit that the plaintiffs are the registered legal owners of the letters patent in question. The defendants, under Sec. 25, Sub-Sec. 2 (*b*) of the Patents and Designs Act, 1907, rely as a defence upon the fact that all the processes and manufactures described and claimed in the specifications filed on application for the Letters Patent 21,513*, 1906, are, and have since the date of the letters patent been, carried on mainly outside the United Kingdom—that is to say, in the United States of America by the General Electric Co., of Schenectady, in the State of New York; by the Westinghouse Electric and Manufacturing Co., of Pittsburg, in the State of Pennsylvania; by the Franklin Electric Manufacturing Co., of Hartford, in the State of Connecticut; in Germany, by the Allgemeine Elektricitäts Gesellschaft, of Berlin; by Siemens & Halske Aktien Gesellschaft G.m.b.H., of Berlin; and by the Deutsche Gasglühlicht Aktien Gesellschaft, of Berlin; and in Holland by the Philips Metallic Glow-Lamp Works, Ltd., of Eindhoven.

Mr. Walter, K.C., for the appellants, said the point raised was a very important one. The plaintiffs could not be attacked through people over whom they had no control. His clients knew nothing about the firms mentioned by the defendants, and had no means of ascertaining anything about them. The order made by the Controller that a patent must be proved to have been mainly or exclusively used abroad, was not sufficient. The order of Mr. Justice Neville meant that the whole of his clients' branches relating to their manufactures were to be open to rival traders.

Lord Justice Buckley: Do you go so far as to say that a defendant, before he can have a general order for discovery, must call witnesses to make out a *primâ facie* case as to the manufactures abroad?

Mr. Walter said he did, and that was what Mr. Justice Parker had held. No one was entitled to have a roving permission to inquire into a man's affairs.

Lord Justice Pickford: You must base your appeal on the ground of oppression.

Mr. Walter said he did. A general order for discovery was far too wide. The order should be limited or restricted.

Mr. T. Terrell, K.C., for the respondents, submitted that the order was a proper one and was necessary for his clients to prepare their defence.

Lord Justice Buckley said there appeared to be two actions. One was for the infringement of a patent; the other was how much business had been done in this country and other countries.

Mr. Terrell said they could not be called two actions. He did not ask that the plaintiffs should disclose all their books. What he wanted was the disclosure of any documents in their possession showing what they manufactured in this country, and how much they imported from abroad. He added: We know what we are fighting about. The plaintiffs have been importing these goods and not manufacturing them.

Mr. Walter: So you say.

Mr. Terrell: I have a right to make that statement. I do not ask for the names and addresses of their customers. Let the discovery be limited to quantities. If that is oppressive, then discovery is oppressive in every case.

Lord Justice Buckley said the defence as to foreign manufactures was in the nature of a counterclaim. It was surely more than a mere defence.

Mr Terrell: It is a defence the Legislature thinks should be allowed in the public interests.

Mr. Walter declared that the defendants' interrogatories were fishing ones. Perhaps he would have to apply for discovery to ascertain the extent of the defendants' trade.

Mr. Terrell: I will give you that now. I say the number you manufacture in England is infinitesimal compared with the quantity imported.

Lord Justice Buckley asked if an order for discovery as to what the plaintiffs directly or indirectly imported, and what they themselves manufactured, would be agreed to.

Mr. Walter objected.

Lord Justice Buckley, after further argument, said that, in his opinion, the two matters in dispute were totally different and distinct. One arose merely in an ordinary action for infringement; the other was very different, raising a point as to foreign manufactures. The latter was a defence that might succeed, notwithstanding that the patent was a perfectly valid one, because the defendants said that under the Statute the plaintiffs were not entitled to any relief. The defendants claimed that they could not be proceeded against successfully if they could show that the patented article was manufactured, or its manufacture was carried on, mainly or exclusively, outside the United Kingdom. The question, he thought, was how far the order for discovery should go; there were alternative courses which might be suggested, but he did not think they would be convenient. He considered that a modified order would meet the case. There would, therefore, be an order for discovery of all documents in the possession or power of the plaintiffs in the usual form relating to all goods imported directly or indirectly by the plaintiffs from the firms and companies mentioned; and discovery of all documents in the possession or power of the plaintiffs showing the amount of manufactures of the plaintiffs in this country, but in all cases without disclosing the names of customers. That, said his Lordship, could not be called oppressive. Lord Justice Pickford concurred.

Electrical Vacuum Cleaners' Infringement Action Fails

Mr. Justice Warrington, in the Chancery Division on Thursday February 4th, gave judgment in an action brought by G. Scammell and Nephew, Ltd., Fashion Street, Spitalfields, against the Galsworthy "Otovacum" Co., Ltd., Newman Street, W., and the Sturtevant Engineering Co., Ltd. Queen Victoria Street, E.C., for an injunction to restrain the defendants from infringing plaintiffs' trade mark "Otovacum," and from passing off defendants' electrical turbine vacuum cleaners as the plaintiffs' goods.

The defendants denied the allegations. The Galsworthy Co. said that the right to use the word "Otovacum" as part of their title, and also the right to sell "Otovacum" cleaners, was transferred to them by the original company, and consequently they were entitled to say that they could get such cleaners made by the Sturtevant Co. so long as they told their customers that fact.

His Lordship said the answer to the plaintiffs' claim that their trade mark had been infringed was that they were not entitled to the trade mark at all, because the company in whose name it was registered never transferred or assigned it. The Sturtevant Co. had contended that they had acquired the right to make the cleaners for the Galsworthy Co., and he thought that was so. As to the claim of "passing off," his Lordship said that "passing off" meant representing to a person that the goods one was going to sell were the goods of somebody else. Such a claim in the present case broke down. The first defendants were entitled to use the word "Otovacum" in their title, and the action was dismissed with costs.

Stolz Electrophone Co. (1913), Ltd.

In the Chancery Division last week Mr. Justice Eve heard an action taken by Mr. W. H. Adams, claiming a declaration that a prospectus of the above company, issued in June, 1913, contained mis-statements of material facts by which he was induced to subscribe for 400 £1 shares. After several days' hearing his Lordship, who described the case as a deplorable one, gave judgment for the plaintiff for £300, with interest and costs.

THE RÖNTGEN SOCIETY.

At the meeting of the Röntgen Society on February 2nd, a paper was read by Mr. Sidney Russ, D.Sc., on some measurements of radiation he has been conducting on the new Coolidge and other X-ray tubes in clinical use. Mr. Russ was appointed by the Dosage Committee of the Society to find out whether the radiation emitted from X-ray tubes running at the same spark gap in various London hospitals was essentially similar and to what extent any differences were important. Several electroscopic measurements were made, and while two out of the four tubes examined were similar in the character of radiation emitted, the others were wholly dissimilar from each other and from the other two. The reason for the large differences was not apparent, but Mr. Russ suggested as worthy of note, without putting it forward as a satisfactory explanation, that of the two bulbs showing the widest variations, one was fitted with a light anode which soon became red hot, and the other had a heavy anode, which was kept cool by a metal radiator. The radiation from the former was very soft, and from the latter very hard. The Coolidge tube, which is a new departure in X-ray tube construction, owing to its high degree of exhaustion and to the fact that its cathode consists of a tungsten spiral which is raised to a white heat by means of a current from a few storage cells, has proved, according to the experiments of Dr. Russ, to have radiation of a heterogeneous character, and to show variation in character, but not considerable, with any alteration of the heating current. The yield of X-rays with this tube was largely increased by a small increase in the heating current, and this increase was relatively larger in the "hard" than in the "soft" radiation.

In the course of the discussion, Professor A. W. Porter suggested that possibly the difference between the results with regard to the homogeneity of the rays emitted by this particular Coolidge tube and the results published by Mr. Coolidge himself might be due to the fact that the tubes which were being put on the market commercially in this country had not had the air so thoroughly removed as Mr. Coolidge removed it.

Dr. Finzi, giving his personal experiences of the tube, said that if only care were taken to have a current of air round the tube enormous currents could be passed through it without dangerously overheating the glass.

Mr. Duddell, referring to some experiments which Dr. Russ had made, utilising selenium as a basis for the measurement of X-ray energy, said that he had been surprised to learn that anybody had produced selenium which was definite in action. He had himself spent a great deal of time in trying to find selenium which was definite in action, but it always varied. Ordinary selenium, he found, varied in resistance from year to year, and finally gave up work.

Mr. Russ said in reply that the selenium he had used had been registering for a few months, but this was not very long to go, and he was anxious to see how its resistance did vary with time.

THE ENGINEERING TRADE AND THE PRESS.

The Engineers' Club of Manchester recently debated the above subject. The matter was opened by Mr. Frank Nasmith, editor of the *Textile Recorder*, and an abstract of his remarks appears below.

After demonstrating the difference between the daily and technical Press in their relation to the trade, Mr. Nasmith said that the total number of technical trade journals published regularly during 1914 dealing wholly or partly with the engineering industries was 97; of electrical journals alone there were published no less than 20, a considerable proportion of the whole. The list given includes trade journals published in relation to such branches of the industry as are concerned in buildings, railways, general engineering, gas engineering, ironmongers, mining, textile and timber. It will, however, be gathered from the figures given that the engineering industries are well catered for as regards technical literature, and when one adds to the foregoing the occasional pages —and supplements—of our better class daily papers, it will be gathered that much information of a varying degree as regards value is published throughout the year.

Now, as regards the value of a technical trade journal to the engineering industry. The following leading heads may, it is thought, be said to cover the field :—

1. The diffusion of knowledge.
2. Record of interesting events, changes, etc.
3. The direction of public opinion.
4. Means of advertising new methods and machinery.
5. The ventilation of grievances.
6. Source of information in query form.

Dealing with the different heads the technical trade Press provides the only means for publishing certain matter which otherwise would never be placed on record. The advertiser—whom some of us pretend to ignore, but without whom we cannot live—does not only get the presentation of his advertisement to a large body of directly interested people among whom are a number of potential buyers, but he also helps to carry on a noble educative work, and is therefore a philanthropist in disguise.

The successful journal as a rule enjoys a wide circulation, and in many cases a much wider reading public. The assiduity with which some members of the Club scanned the new contracts and invitations to tender columns of technical trade journals was referred to. At the same time, it must be agreed that a deal of matter which would otherwise remain unpublished is distributed to the right quarters by our technical trade Press. Information on all topics relative to the engineering trade, critical and analytical articles by experts, descriptive matter about new plant and undertakings, abstracts of the more important patents, innumerable notes, etc., etc., all go to make up the weekly or monthly issue of the standard engineering journals. The technical Press extending, as it does, now over many years, forms a record of engineering progress of a quite invaluable kind. Even a hasty perusal of the pictures alone in the back numbers of some of our leading journals will demonstrate the rapid strides we have made and the way we have reached our present advanced position. As a means of reference old volumes of engineering journals should be more frequently consulted, and if they were it would be found that many so-called new ideas were tried—and often discarded—years ago. In patent actions the engineering journal often plays an important part, and cases have been lost through a careful perusal of early issues.

As a means of bringing before potential buyers new ideas in machinery, the technical trade Press is pre-eminent. The engineering editor of the daily Press in the main holds himself aloof from the mere descriptive matter relative to a new machine, which usually finds a ready place in the pages of the majority of our technical trade Press. He—the daily Press expert—is precluded from mentioning the maker's name, and naturally the maker, looking for a little cheap advertisement, cannot see the value of a description without his name attached to it. At the same time, one cannot but think harshly of those journals which publish what are technically known as "puffs." Unless the new or the improved machine possesses novel features, a description of which will interest and educate the reader, an editor should not be asked to insert a notice. A practice which I have always deprecated and looked upon with disgust is for the literary matter to follow the advertising, or, to put it in plainer words, for the advertising canvasser to dictate what the editor shall insert. The better class journals would rather lose advertisements than pursue such a practice. To come back to our particular head. It will be generally conceded that the technical trade Press do provide the potential buyer with information relative to new machinery and enable him to keep abreast of times which are often extremely rapid.

The technical trade Press, especially where journals have been established for a number of years, has at its command a remarkable fund of information, and as this is at the command of enquirers, it performs a very useful work as a technical information bureau.

"There is one thing the technical trade Press suffers from—and unfortunately, from our point of view, it is growing—that is what I may term subsidised competition. It is no use burking the fact that we all live by our advertisement revenue, and although it can be clearly proved that a well established journal gives good value for the money paid for advertising space, the fact remains that firms support Association journals that have a comparatively small circulation. Such journals publish—in the great majority of cases—only reprints of papers and do not give the great mass of useful and general information contained in the high-class technical trade journal. Now firms only set aside a certain sum yearly for advertising purposes, and if these subsidised journals get a share there is naturally less for the independent self-supporting journals. In a way such competition is unfair, and in my opinion no journal should be published by any parties who are directly concerned in the trade amongst which it circulates."

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

The British and Overseas Trade.

The long and interesting letter from the New Zealand correspondent in your current issue commends itself to me particularly as it endorses, almost word for word, my letters on the same subject which you were so good as to publish from September 7th last and onward.

It has occurred to me that if the Colonials care to bother with the matter (for the last time, perhaps), a final shot might be made at our home manufacturers by important Colonial buyers, after due consideration, issuing a declaration as to what British firms *must* do and conform to in order to retain a fair share of Colonial business. Make the declaration mandatory and very definite in tone, and give the Britisher, say, one year from the close of the war to speed-up, get efficient and modernise. The Press (both technical and lay) would, I feel sure, give the matter wide publicity here, and the importance of the movement might be further driven home by pointing out that Canadians have largely gone over to American and German goods (the latter, of course, before the war), and Australia in due course will, as things are going, be forced to do the same. The Colonials would have to avoid making the declaration through any of the big trade associations here, as these strange organisations seem to be taken up with proceedings which are the negation of the most embryonic intelligence, or if they miss this development they are so slow that they only figure as useless and costly babblers. What are needed in respect to the overseas business are actions which correspond to assertions.

I would like to add that the much appreciated space which you afforded some of us for the discussion of "Advertising and Character" received a very wide publicity apart from your influential journal, as the opening of the subject was alluded to in *The Advertising World* for January, while the *Advertisers' Weekly* for January 23rd reproduced the major part of my letter from your issue of the 8th, adding a favourable editorial comment. As I know from much experience what an important part genuine publicity work plays in the opening up and development of overseas trade, I may be excused for this apparent digression.

Arthur Mallord Turner.

London, S.W., *February 8th*, 1915.

Electricity Supply on the Large Scale.

I have perused with interest your leading article on the lecture by Mr. Charles H. Merz to the students of the Institution of Electrical Engineers, in your issue of February 5th.

If it is a fact that the inter-connection of large adjoining areas for the purpose of supplying electricity is "essential to reliability combined with economy," the economy is not apparent to the shareholders of the companies operating on the North-East Coast, with which Mr. Merz is closely identified. The commercial results after eight years' working of one of these groups of businesses are not a penny dividend to the ordinary shareholders, plus £58,000 arrears of preference dividend, besides a loss of some hundreds of thousands written off capital account in 1910. It is unfair to your readers that you should give an impression of successful development that has not been achieved, so far as the North-East Coast supply of electricity in the Cleveland and Durham area is concerned.

The group of electric power companies operating on the North-East Coast exercise large Parliamentary powers, but they evade Parliamentary obligations regarding the publication of statistics. If these companies would frankly publish, as all the London electric supply companies and all municipal electrical authorities do, their statistics as to working costs per unit, price received, total units sold, etc., it would be more useful to the consumer, the investor, and the general public, whom the Electric Lighting Acts were meant to protect, than any startling figures Mr. Merz may give to a meeting of students when there are no means of verifying the statements made.

Could Mr. Merz explain why the results of the Cleveland and Durham group of power companies have been so disastrous to the shareholders under the waste-heat scheme and the inter-connection of large areas, and why the profits have been so very far short of the profits which were estimated to accrue without waste-heat?

The success of any particular system of development of an electricity supply undertaking and the reliability of its service to the public cannot be assured by any logical process that leaves out of account the question of commercial result and financial stability. In fairness to your readers I ask the insertion of this letter in your journal.

Andrew Gemmell
(A Shareholder).

Ovingham-on-Tyne, *February 8th*, 1915.

A.C. v. D.C. for Lighting.

I have great pleasure in replying to Mr. Hall and to Mr. Wardle regarding the question of A.C. versus D.C. for lighting. I note their comments to my letter on this matter in your issue of February 5th.

Mr. Hall states that the source of supply does not determine the number of live wires which one has to contend with, say, from a distribution panel or box. There is a considerable difference between a three-phase distribution panel and a three-wire D.C. panel, which he will probably find out for himself at some future time if he comes to deal with the sources of supply I have mentioned.

He seems to be under the impression that an earth return means a return by earth itself, as, for instance, in magneto, or battery call, telephone earthing; such, however, is not the case in lighting or power work, in which the return conductor must be insulated if carrying above five amperes, B.O.T. regulations. The fact that he is under this impression is verified in his statement, that if an earth return is used, which is rather unsatisfactory (he here makes no mention of the three-wire D.C. system) the low-voltage alternating current would be less troublesome than the D.C. current of electrolytic propensities.

Regarding the cost of installation of electric lighting, Mr. Hall will some day have the fact brought home to him, perhaps rather unpolitely, that cable costs money. No matter how small the installation may be, the firm who employ him expect him to use discretion in the matter of cable. With due regard to mechanical strength of cables, this point is governed by the method of wiring adopted, and only in such places where the cables are exposed, and liable to be much handled, or repeatedly moved about whilst loaded with current, need the question of mechanical strength be taken into consideration. In ship repair work, or on large plant work where temporary cables are slung about anyhow and regarded more or less as so many ropes, the doubling of the ampereage by the halving of the voltage is a serious point which must not be overlooked when taking into account their selection, having regard to capacity and strength.

I wonder what gave Mr. Hall the impression that my experience had been with the older squirted filament lamps, and not with the modern tungsten drawn-wire lamps also. I can assure him that I remember the introduction of both types of wire lamp, and have used a few of each during past years. I certainly did not say in my letter of the 29th January that the drawn-wire lamps were extremely fragile.

He seems to be under the impression that the filament of the 110-volt lamp is of a greater diameter than that of the 230 to 250-volt lamp. During my experience I have not noticed any difference in the size of the filament in the respective lamps I have just mentioned. I paid particular attention to this point whilst inspecting the construction of drawn-wire lamps at our largest lamp works in London about a month ago. Traction or supported-filament lamps are made in any voltage as required. The thickness of the filament is only increased as the candle-power is raised and the size of the bulb enlarged. I was unaware that I had attempted any hedging in my letter, and, although I mentioned accumulator charging as being in favour of D.C. supply, I did not expect it to be made a point of argument by Mr. Hall. Perhaps he will tell us what he means by the phrase "general handiness for lighting purposes."

It is, of course, only natural that electricity supply companies, for whom I take it our friend is working, should endeavour to push A.C. lighting. Most Corporations now generate high-tension three-phase current which is transmitted to the outlying sub-stations to be converted to working pressures for local distribution. Apart from the expense of running rotary converters to obtain D.C., there is the difficulty of generating H.T. D.C. Static transformer losses are very small, hence the advent of A.C. supply for lighting and power. Experience with both classes of current enables me to speak with some slight knowledge of their respective merits.

Re Mr. Wardle, I am pleased to say that I quite agree with him as to the feasibility of the bonded earth return of the A.C. lighting circuit. Seeing, however, that the sheathing whilst carrying current in a wet position may come in contact with a better earth than that provided already, a leakage may easily lead to a serious fire without any means of breaking the arc. If, however, the fourth or earth wire be also insulated the danger is lessened accordingly.

The system of supply mentioned by Mr. Wardle means that instead of the supply being across two phases of a three-phase transformer, he is across one phase only and one earth conductor, which eventually terminates at the centre of the star connections of a three-phase alternator stator. As the B.O.T. regulations compel the supply company to insulate the earth conductor of the mains leading up to a building, it seems strange that they should overlook the bare sheathing return which, if ruptured, would cause an arc and probably a severe burn out. I should fancy this is a point for insurance people to deal with. It is evident that you could not use such a system for power or heavy lighting circuits above five amperes. Private plant power and lighting is always across two phases, and not one phase and earth. At least, this has been my experience personally, and also what I have noticed on other plants.

Hoping that Mr. Wardle will treat my reply to him in the same spirit as I have received his, and that my letter may be instructive to other readers of the "E.R."

Henry Fowler,
Electrician-in-Charge.

Liverpool, *February 6th*, 1915.

Street Lamps in Chicago.

In the October 9th, 1914, issue of the Electrical Review (London), page 504, under the heading "Notes," there was an abstract of an article in the *Electrical Review and Western Electrician* (U.S.A.), entitled "Half-Watt Street Lamps From Chicago." I wish to call your attention to a serious error in this abstract. In the last paragraph, a statement is made as follows:—

"The arc lamps which are to be replaced are 450-watt flame type arcs numbering some 10,000 which were adopted as a standard rather more than two years ago."

If you will refer to the last paragraph on page 512 of the original article in the *Electrical Review and Western Electrician* on September 12th, 1914, you will note that the gas-filled lamps (so-called half-watt lamps) are to replace 10-ampere direct-current open arcs and 7-ampere alternating-current enclosed arcs, the enclosed flame arcs remaining as installed. Such errors are inexcusable.

S. C. Rogers,
Arc Lamp Eng. Dept., G.E.C.

West Lynn, Mass., *January 9th*, 1915.

[We may remind our correspondent that a sentence simultaneously appeared in the leading columns of our contemporary, which reads as follows:—"The most striking feature of the Chicago installation with the new 300-watt lamps is that they will be used as a standard unit in place of the 450-watt flame arcs that were adopted a little over two years ago and of which some 10,000 have been put in service." The article in question set forth the merits of the 600-C.P. half-watt lamp as against those of the flame arc, describing experiments carried out in Chicago to the advantage of the former; we regret that the paragraph quoted by Mr. Rogers was overlooked, but in view of the strong editorial comment of our contemporary which we reproduce above, and the tenor of the whole article up to the last paragraph, we feel that our impression was not unjustifiable.—Eds. Elec. Rev.]

The City and Guilds Exams.

I have had my attention called to the fact that the City and Guilds of London Institute, in its examination papers on electrical engineering, is still asking questions of this type:—

You have N cells, each with an electromotive force of e volts and a resistance of r ohms. How would you arrange them, S in series and N/S in parallel, so as to make them send their greatest possible current through an external resistance of X ohms?

And, as the rule taught even in the latest text books could only give a correct answer by accident, perhaps you will allow me to state the following very easy rule of my own, which is demonstrably good for every case:—

Let A be a smaller number than B. Then S = A will give a smaller current than S = B, if A B is smaller than NX/r; but not otherwise.

If your readers will try this with N = 14, X = 1.4 and r = 1, they will find that it gives them the right grouping with even less trouble than the usual rule gives them the wrong one, and that the increase of current with my rule is over 20 per cent.

For a demonstration that my rule must hold good in every case, I must refer your readers to my pamphlet on the Grouping of Electric Cells.

W. F. Dunton.

Newcastle-on-Tyne, *February 4th*, 1915.

Electric Lighting Authorities and the Law of Rating.

I have read with much interest the recent article in your columns on "Electric Lighting Authorities and the Law of Rating."

Your contributor states the matter fairly clearly except in regard to the portion referred to as "tenant's share." He explains what this item means, but adds that "it would not, of course, include the value of the boilers, engines, dynamos or other fixed machinery at the central station," and I cannot trace throughout the figures that any percentage whatever is taken in regard to capital cost involved in the works. I was always under the impression that some percentage of the capital cost involved was allowed, the amount varying with the age of the plant and the loan period.

I should be glad if your legal contributor could give a little more explanation on this point.

Fredk. W. Purse,
City Electrical Engineer.

Carlisle, *February 2nd*, 1915.

The statement in the article referred to that the tenant's share would not include "the value of the boilers, engines, dynamos or other fixed machinery at the central station" was founded upon the decision in R. v. Lee (1866), L.R.I.Q.B., 241. According to Mr. Ryde in his "Law of Rating," p. 279, that case decides that in arriving at tenant's capital, the hypothetical tenant must be supposed to provide "all the necessary stock-in-trade, coals, tools, and loose machinery necessary for carrying on the business. These include (in the case of a gas company) the meters placed on their customers' premises, but not the retorts, purifiers, steam engines (used for driving machinery and fixed by screw-bolts), boilers or gasholders, all of which are valued as enhancing the value of the freehold."

It is true, as stated by your correspondent, that no deduction for the tenant's capital is specifically mentioned, but it is included in the item "Tenant's share 17½ per cent. on £51,000." referred to in the table of figures headed: "Ascertainment of Rateable Value," which appeared in the article. According to Mr. Ryde (*loc. cit.* p. 280) "The hypothetical tenant must also provide sufficient capital to carry on the business until he receives enough money from that business to meet the current working expenses including (*inter alia*) the rates."

As to there being any deduction on account of "capital cost," I do not know of any such deduction being allowed.

The Writer of the Article.

The Acquisition of Enemy Patent Rights.

A very interesting aspect of the relative trades of the United Kingdom and enemy countries is offered by the statistics of firms or individuals to whom British patents have been granted in recent years. In 1911, for instance, out of the 17,164 fully granted British patents of that year, it is surprising to see that 2,886 were granted to residents of Germany, and 325 to residents of Austria. Nearly a fifth of the patents of the United Kingdom have in recent years been passing into the hands of enemies.

In many cases the articles or processes controlled by these enemy patents are manufactured or carried on mainly or exclusively abroad, the British patents being used merely for the purpose of closing the English market to persons other than the patentee.

In 1907, a strenuous effort was made to compel foreigners to manufacture in this country the articles protected by their British patents. As you are aware, the law was to the effect that anyone could apply for the revocation of the patent on the ground that the patented articles were being manufactured mainly or exclusively abroad. This effort has not by any means given the results which had been desired. It is surprising to find that throughout the four years next subsequent to the commencement of this law, *i.e.*, until December, 1911, only 81 applications for revocation were lodged. Out of these, 42 applications were abandoned or dropped owing to expiry of the patents. On the whole, during the period referred to, there were only some five patents per annum actually revoked for non-compliance with the law.

Upon the commencement of war, new and practically unprecedented conditions arose. It became substantially a physical impossibility for the German patentees to continue to import their patented articles into this country, and in the large number of cases in which no British manufacture had been commenced, British subjects were wholly unable to obtain these articles, and they were, furthermore, unable to manufacture, as the patents still in fact existed and remained the property of the enemy proprietors.

An emergency law was, as you are aware, very soon introduced, the result of which now is that any British manufacturer can apply to the Board of Trade for the right to manufacture under any enemy patent. The right is granted in the form of a personal licence, and it is now definitely established that the British manufacturer will not be deprived of his right to manufacture upon the termination of hostilities.

That the emergency law is of far greater value than the 1907 law is proved by the fact that throughout the past few months of war, and notwithstanding the adverse circumstances existing as a result of the war, there have been 248 applications for this right to manufacture, as compared with the 81 applications which were made throughout the four years following the introduction of the 1907 law.

An obvious reason for the enhanced value of the emergency law is that it confers a certain degree of monopoly in favour of the one applying for the right to manufacture. The entire revocation of the patent, as in the practice under the 1907 law, has the disadvantage that the applicant for revocation, after having gone to the trouble and expense of his application, is, when he succeeds, placed only upon the same footing as all other manufacturers in the country. Such other manufacturers are vested with an equal right to manufacture without having contributed to the trouble and expense involved in nullifying the patent.

Having, therefore, in view the merits and advantages of the emergency law, and having in view also the large numbers of valuable enemy patents which are in our midst, it appears eminently desirable that no time should be lost in taking all possible advantage of the facilities which are offered, as, while the benefits conferred during war will continue to exist after the expiration of hostilities, the opportunity of obtaining them is of duration substantially limited to the period of war.

Lewis Wm. Goold, F.C.I.P.A.

Birmingham, *February 6th*, 1915.

Consulting "Engineers."

It is curious to note, in most large towns, certain individuals who rent a small office, fix a brass plate, lay in a stock of stationery, and open out as full-blown consulting engineers.

One such gentleman we have in mind who obtained his engineering training in the manufacture of artificial teeth. Another one was formerly a draper, and so on with other instances that might be quoted.

The most surprising thing is that these persons are occasionally employed by large firms, who, one would naturally expect, would look more closely into the qualifications of those to whom they entrusted their work.

Delta.

February 8th, 1915.

WAR ITEMS.

Copper Enough for Thirty Years!—At the quarterly meeting of the Association of German Ironmasters, held at Düsseldorf on January 31, Dr. Schuster, the secretary, stated that when the stocks of copper in Germany were exhausted the Germans would seize everything made of copper in the parts of Belgium and France occupied by them. (By all accounts they have already been doing so for the past two months.) They would take electric wires, kitchen utensils, fittings from sugar refineries and other industrial works—everything down to the very door-handles. After that, if necessary they would strip Germany of copper, and by taking the metal off the roofs of public buildings and melting down their bronze monuments they would have enough to last them for thirty years. Which reminds us that in the other Thirty Years' War Gustavus Adolphus of Sweden thus addressed the silver statues of the Twelve Apostles he found in a church: "Gentlemen, how is it you are standing here doing nothing? Don't you remember your Master ordered you to go about through the world?" And he promptly melted them down and minted them into dollars.—"Ironmonger."

Employment of Belgian Engineers.—We read in the "Times" that during the last few weeks a large number of Belgian engineers have been engaged at Messrs. Vickers' works at Barrow. There has been a very big demand for engineers owing to the large Government orders for war purposes, and although a great many additional British workmen were taken on, the supply was insufficient. Arrangements were therefore made to employ a small party of Belgians to begin with, and the experiment proved so satisfactory that others were sent for, and now 900 Belgians are employed by the firm. The greatest difficulty has been to find houses for the men. The engineers so far have shown themselves to be very efficient workmen, although many of them are now doing a class of work differing largely from that which they have been used to. They work very satisfactorily with their fellow British workmen, and arrangements are now being made to introduce Belgians at the works of the Furness Railway Company at Barrow.

Board of Trade Assistance.—The Board of Trade continue to receive a very large number of enquiries for the names of sellers or buyers of articles of which the sources of supply or market have been interfered with by the war. Special arrangements have been made in the Commercial Intelligence Branch of the Board of Trade for dealing with these enquiries, and lists are prepared and circulated of articles which enquirers desire (a) to purchase, and (b) to sell. The eighth list is now ready, and may be obtained by United Kingdom manufacturers and traders. British firms interested in any of the goods mentioned, either as buyers or sellers, should communicate with the Director of the Commercial Intelligence Branch of the Board of Trade, 73, Basinghall Street, London, E.C.

Maximum Prices for Metals.—According to a U.S. Consular report, the German Federal Council has issued an order establishing maximum prices on copper, brass, and other

metals. The regulations became effective on December 14. The maximum prices are indicated in the table following, and are applicable to metals marketed within the German Empire:—

Metals.	Price per 100 pounds.
Refined copper	£4.45
Scrap brass	3.22
Red brass (gunmetal)	3.88
Aluminium	7.21
Nickel	10.0
Refined antimony	3.32
Tin	11.1

Trade in Belgium.—Everyone anticipates that when the war is over Belgian manufacturers and merchants will give preference to trade with the Allies, indeed, we have already had ample evidence to that effect. We are now informed that some influential Belgian business men have taken steps with a view to organising an office called "For Commerce with the Allied Nations," the temporary address of which is c/o London Chamber of Commerce, 97, Cannon Street, London, E.C. Its objects are to secure for well recommended and fully qualified Belgians the agency in Belgium of British firms, and to answer enquiries from Belgian firms who are desirous of replacing foreign goods by their English equivalents. Trade papers, catalogues, etc., are invited and they will be filed in order to give all possible assistance to enquirers.

Anglo-Russian Commerce.—Reuter's agent at Odessa (according to the "Financial Times") says that the local branch of the Anglo-Russian Chamber of Commerce, at a well-attended meeting, discussed the further development of the commercial relations between the two countries. The present time was regarded as a very favourable moment, and it was decided to study questions of railway tariffs, and to reorganise the Chamber, so that it may incorporate the great possible number of members of the British colony interested in trade and industry. The British Consul was elected as honorary member.

Swiss Aluminium.—According to a Schaffhausen newspaper, the French Government has placed under control of State officials the Marseilles branch of the Aluminium Industry Co., of Neuhausen, Switzerland. A seizure of stocks has not taken place, as no aluminium is reported to have been found on the premises. It is assumed in certain German circles, who are interested in the Neuhausen Company, that the Swiss Federal Council will lodge a protest against the action taken by the French Government in regard to "the French branch of a Swiss undertaking."

Lamps for Malay States.—Before the war the price of a 25 c.p. tungsten lamp in Kuala Lumpur was never more than 2s. 4d. The Board of Trade correspondent for the Federated Malay States says that these lamps mostly came from Austria, some from the Netherlands, and some were not marked with country of origin. The Netherlands are now furnishing a supply at 3s. 6d. each. It is suggested that British firms have not sufficiently realised the opportunity afforded by the war of gaining a footing in this market.

Salary Advances to Men on Active Service.—The Tramways Committee of the Bradford Corporation have decided that as regards employés in the Tramways Department who are on active service with the Navy or Army, any advances of wages falling due to them under scale shall accrue as usual, notwithstanding absence from work in the department.

Personal.—Sapper Walter Fox, who is in the Naval Engineers of the Colonial Defence Corps at Singapore, was up to a few months ago an electrician in the employ of the Stalybridge, Dukinfield, Hyde, and Mossley Joint Tramways and Electricity, Ltd.

Private M. J. Fox, of the 4th Middlesex Regiment, who was for six years employed in the Rochdale Corporation tramways department, has been awarded the Distinguished Conduct Medal for bravery in the field.

Company Sergt.-Major Thos. Perkins, an employé in the Wigan tramways department, has received a commission as lieutenant and transport officer.

Mr. F. C. Locke, of the Anchor Cable Works, a well-known athlete, has joined the Sportsmen's Battalion.

Private John Brand, of the 8th Royal Scots, who previous to the war was employed at the Dalkeith Electricity Station, made a valiant attempt to save his Captain. Brand dragged the officer, who was wounded, into safety, and after three hours' crawling arrived at the British trenches. Unfortunately the officer expired. Brand has been in hospital suffering from severe strain.

We recently mentioned that Mr. S. W. Carty had resigned his position as overhead superintendent with the Liverpool Corporation Tramways Department, and had obtained a commission in the Army Service Corps. We now learn that Mr. Carty has not resigned, and his position is being kept open for him by the Corporation.

The following notice appeared in the "London Gazette" on Tuesday:—

Territorial Force.—London Electrical Engineers: The undermentioned Second Lieutenants to be Lieutenants (temporary). Dated January 1st, 1915:—Thomas F. Middleton-Case, George R. Madge, Maurice G. Bland.

Mr. Fred Middleton, electrical engineer, of Park Road, Hadfield, Glossop, has joined the 3rd Southdown Royal Sussex Regiment.

BUSINESS NOTES.

Consular Notes.—TASMANIA.—*Machinery Trade.*—In reviewing the machinery import trade of Tasmania for the first half of last year, the United States Consul at Hobart notes that in electrical plant and appliances the bulk of the trade was supplied by Germany and the United States, despite the preferential tariff to Great Britain. The United States figured exceptionally in the importation of dynamos, but this trade is irregular, and it may be many years before Tasmania may again be in the market for such a large supply, whilst the considerable imports of general electrical appliances are staple. It is in these latter lines that business should be developed. The United Kingdom made a strong showing in portable engines, and had appreciable success in motor-power machinery, sharing the latter line with the United States. Sweden provided about half the total imports in this class. On account of the rapid development of electric power in Tasmania, the sales of such machinery should show a gradual development. Present indications, the Consul says, point to a normal trade in all lines of machines and machinery except those for mining, which industry is stagnant on account of the low price of tin and the entire loss of a market for other products. As was shown in our issue of February 5th, the tariff preference to British manufactured machinery has been increased.

THE RUSSIAN MARKET.—In the hope that the seed may possibly fall on fruitful ground, H.M. Consul-General at Moscow reiterates, in his recently issued report, the oft-told tale of British indifference to local requirements, of the "take or leave" attitude shown by the British manufacturer in many cases where the error of his ways is pointed out by the Consular officer, his own agent, or a prospective customer, all of whom, being on the spot, are much better qualified to judge of the requirements of the market, and the best policy to pursue to meet local and foreign competition.

In Moscow, says the Consul, there is an opening for every class of British merchandise. Even with the high import duties in force British goods can compete in many cases with the locally-made and protected article by reason of their superiority, and the Russian customer is quite willing to pay an enhanced price for the best qualities. Meanwhile, on every side, one has seen German goods. An inquiry for an article of British manufacture will be met with an expression of regret that it is not saleable in Moscow, but a substitute has been forthcoming, patently of German origin, which not seldom bears a description or name in English, generally misspelt, but, nevertheless, a subtle piece of flattery to the selling power of the British article, if it were only to be found on sale.

In seeking business in Russia the Consul emphasises the importance of granting credit. Firms not willing to grant credit for four or six months after the receipt of goods had much better not attempt to enter this market. Their German and French competitors will at once offer such credit as is desired, and the efforts of the British trader will be useless. The request for credit is no captious demand in Russia, but an essential corollary of a commerce carried on in a vast Empire in which railways are few, markets widely separated, and roads bad and often non-existent. The majority of the customers are peasants who can only pay on the realisation of the harvest, and the retail merchant must have credit to allow him to carry any stock. The great question does not, however, lie merely in the granting of credit, but to whom the credit is granted; and where British merchants and manufacturers are at fault is that they will often grant credit where none should be given, and when once bitten refuse it where it should be granted freely. This state of affairs is due to the imperfect knowledge of Russian conditions, and can only be rectified by the intimate personal knowledge which can be gained by frequent visits of principals or travellers to this country.

An instance of how not to grant credit may be taken from the following case:—A British firm, wishing to enter this market, applied to the Consulate at Moscow for information as to the standing of an agent who had been recommended to them. Though it was known in the Consulate that the agent bore no good reputation, further inquiries were at once set on foot, which not only confirmed the previous information, but rendered it imperative to warn the British firm most strongly against the man. Disregarding the Consular advice, on the strength of a banker's recommendation the man received the agency. Within six months the British firm lost many thousands of pounds, and have applied to the Consulate to assist them to collect what is due to them.

British manufacturers and merchants must also remember that in a great trading and manufacturing centre like Moscow, there are many of their fellow-countrymen who by their foresight and adventurous spirit have not only traded with, but established factories in, the district, and whose interests have to be as much consulted as those of any other British subject. Many of these are men of substance and buy for their own account from the United Kingdom, but there are also numbers of others who, though not in affluent circumstances, are anxious and willing to undertake agencies. These men are generally thoroughly conversant with Russian customs and requirements, and speaking Russian themselves would be most useful to British firms. In order to employ such men it is generally advisable to make some advance or to supply a stock free of charge, and any expenditure thus incurred is generally compensated for by the extra reliability and commercial integrity of such persons as compared with those of another race.

ITALY.—*Government Contracts.*—The United States Consul at Rome has been actively investigating the openings for increasing American trade with Italy which have arisen since the outbreak

of war. Although many of the opportunities he indicates must be considered as temporarily deferred owing to the depression in business caused by the earthquake, it is useful to put on record his advice with regard to obtaining Government contracts in Italy, as to which conditions are somewhat peculiar. There are certain well-established contractors in Rome who have obtained Government orders, and it is almost unprecedented for such orders to be placed through other mediums. Apparently, also, the Italian Government will not deal in the first instance direct with actual—at least foreign—exporters and manufacturers, but insists that negotiations be carried on through a local agent; it is also a common experience for the principal to the transaction to receive direct communication from the Government purchasing department over the head of his agent. This is doubtless the reason why local agents demand exclusive representation for such business, in order to protect themselves against loss of commission. It is also customary for the Italian Government to demand a deposit of 10 per cent. of the total value of the order upon signing the contract to insure prompt delivery, and this deposit is returned only upon completion of the contract. It is possible that this onerous condition would now be renounced.

Shortage of Electrical Goods in Spain. — The Fomento del Trabajo National, which was called together to adopt measures to meet the crisis in the electrical goods market, has arrived at certain decisions, which the American Consul at Seville quotes from the *Revista Comercial*. To carry out these decisions it is proposed to nominate a committee, composed of members of the Association of Industrial Electricians of Cataluna, the Metallurgical Association of Spain, and other representatives of Spanish industries. The proposals are:—

1. To obtain from the Government a tariff reduction on all electrical materials manufactured outside of Spain, by means of a regulated tariff.
2. To ask the Government to make inquiries through the various ambassadors abroad which country is best able to supply these materials; at what prices, and on what conditions, if for personal account or account of the committee mentioned, which would undertake to supply all Spain.
3. To inform the manufacturers in Spain that in the event of their needing materials they should inform the committee, which will facilitate their obtaining them and also price lists.
4. To get in touch with the sellers of materials who had offered them at customary prices, secure detailed information regarding these goods, and distribute this information to the industrialists of Spain.
5. To ask the help of representatives of foreign houses in ascertaining if their houses can supply materials, and the prices thereof.

New Zealand.—A firm in Wellington wants to add sole agencies for British makers of glassware, electric lamps, and carbons. H.M. Trade Commissioner, P.O. Box 369, Wellington.

Anglo-Norwegian Trade.—The Norwegian Chamber of Commerce, London, Inc., Kingsway Chambers, Kingsway, W.C., has received so many inquiries respecting trade and other matters that it has now published an official organ with the object of fostering trade between England and Norway. A copy of the first monthly issue is before us. It is entitled the *Anglo-Norwegian Trade Journal*, and contains brief articles on such matters as the import trade of Norway, Norwegian copper imports from America, exports prohibited from Norway, prohibited exports from the United Kingdom, a trade inquiry department, and so on.

Improved Outlook in Argentina.—The American Consul-General at Buenos Aires reports that the end of November was signalised by an entire change of tone in Argentine commercial and financial circles. The prospects for the immediate future were generally regarded as very reassuring. Notwithstanding decreased foreign trade due to over-speculation and enforced retrenchment, together with poor crop returns, the country is looking forward to the results of the coming crop with a strong measure of confidence. Given usual prices the export year 1914-5 is expected to prove "to be the greatest in Argentine history." Horses alone to the value of £4,000,000 (300,000 in number) are now being selected for European countries. "The immediate effect of the more hopeful tone in the general market has been already shown in increased banking movements and in a general inclination throughout commercial circles, particularly among importing houses, to make preparations for future business." Another Consul mentions that $107,000 is eventually to be placed at the disposal of the Ministry of Public Works for remodelling a Government building in Rosario to meet the needs of a local Post Office. Plans submitted by the Director-General of Architecture have been approved.

The U.S. Consul at Rosario reports that a company is in process of formation at Santa Fé for installing and operating light and power plants in the cities and agricultural colonies of the Province. The capital is to be $424,600, and it is reported that the first of five series of $84,920 each has already been subscribed. The promoters stated that operations were to be commenced on January 1st, 1915. Communications should be addressed: Sr. Armando Antilla, Gral. Lopez 87, Santa Fé.

Canada.—An Edmonton company already handling certain British electrical lines wants to take up further British agencies. The name and address can be ascertained at the Board of Trade Commercial Intelligence Department in London.

Book Notices.—*Lockwood's Builders' and Contractors' Price-Book.* London: Crosby Lockwood & Son. Price 4s.—This useful work contains a section on electric lighting, which has been revised by Mr. A. P. Haslam, and includes, besides general information, a number of price lists, mostly under the names of well-known firms. Some estimates of the cost of wiring small installations, as well as of the running cost, are also given. There are some features to which we may take exception: we doubt whether lead-covered wire with paper insulation has any vogue nowadays for house wiring; on p. 380, after an estimate for lamps using 21 watts, it is stated that 20-watt lamps (of the same C.P.) are now obtainable, which enable the charge for energy to be "considerably reduced;" and on p. 390 we read "Geeks" for "Geeko." As a whole, the book contains a mass of information, about one-third of its contents consisting of legal notes, building Acts, regulations, &c.

Spon's Architects' and Builders' Pocket Price Book (London: E. & F. N. Spon, Ltd. Price 2s. 6d. net) for 1915 has been issued, with revised prices, and, we understand, new matter, though its size remains the same as last year. In the "Electrician" section the only changes discernible are the substitution of metallic-filament lamps in the table on p. 222 for the carbon-filament type, and slight alterations in the table of lamp prices, &c., on the following page. The difficulties experienced by the editor of such a publication at such a time as this must be considerable, when the prices of some materials are subject to rapid change, and he has our sympathy. The book is a very handy one, and convenient for the pocket.

The Colliery Manager's Pocket Book and Diary for 1915, edited by H. Greenwell (London: *Colliery Guardian* Co., Ltd. price 2s. net) is in its forty-sixth year of publication, and needs no introduction to our readers. It is indispensable to colliery officials, amongst whom the electrical engineer now occupies a place of constantly-increasing importance. Special sections deal with the regulations affecting the use of electricity and the duties of those in charge, and there is a mass of general information on all mining questions. It is certainly an excellent publication.

"*Journal* of the Institution of Electrical Engineers." Vol. 53, No. 241. February 1st, 1915.—This issue contains papers on "The Shape of the Pressure Wave in Electrical Machinery," by S. P. Smith and R. S. H. Boulding; "The Magnetisation of Iron at High Flux Density, with Alternating Currents," by J. S. Nicholson; and "The Current Transformer," by A. G. L. McNaughton. London: E. & F. N. Spon, Ltd Price 3s. 6d.

"Annual Report" of the Director of the Bureau of Standards for the Year ended June 30th, 1914. Washington, U.S.A.: Government Printing Office.

"Model Power Boats." By E. W. Hobbs. London: Percival Marshall & Co. Price 5s. net.

The *Central* for December contained articles on the maintenance of a railway (by A. C. Cookson), the efficiency of electric radiators (Percy Good), the Wilson induction coil (H. R. R. Moore), and Canada (J. H. P. Daman). There is also the first instalment of the "Old Centralians' Roll of Honour."

The *Faraday House Journal* for the Lent Term contains articles on "Transforming from Three-phase to Two-phase for Single-phase Distribution" (by L. Romero); "Weddle's Rule for Finding Areas," and "Fourier's Theorem" (by Dr. Alex. Russell), and "Saturation Effects in A.C. apparatus" (by F. T. Chapman), and supplementary lists of present and past students who are serving with the Colours.

"Recenti Progressi della Telegrafia e della Telefonia senza fili." By G. Vallauri. Reprint of a paper read before the Associazione Elettrotecnica Italiana.—From the author.

"Science Abstracts," Sections A and B. Vol. XVIII. Part 1. January 30th, 1915. Price 1s. 6d. each net. Index to Vol. XVII, Sections A and B. London: E. & F. Spon. Price 1s. 6d. each net.

"Dynamometers." By Rev. F. J. Jervis-Smith, M.A., F.R.S. London: Constable & Co. Price 14s. net.

Electrical Fires. — The value of the Pyrene fire extinguisher, which was described in our issue of February 20th, 1914, has been demonstrated by its successful use on several occasions at the Bexley U.D.C. electricity works. A fire broke out among the rubber cables of the old H.T. switchboard, which would have led to disastrous results had it not been for the promptness with which the fire extinguisher was used. On another occasion a burn-out took place on a traction generator, and, in this instance, the damage done to the machine was comparatively small on account of the efficiency of the extinguisher. A third instance was a burn-out on a single-phase alternator armature coil, which was quickly put out without finding it necessary to stop the machine, which is one coupled in tandem to the traction generator. The fire extinguisher has also been used on small outbreaks in the workshop and boiler-house, and Mr. H. P. Stokes, electrical engineer and tramway manager, expresses himself as perfectly satisfied with the success of the device; he specially emphasises the fact that in no instance has any injury been caused to the electrical apparatus on which the fires have occurred, the fluid used being a non-conductor.

For Sale.—Salford Electricity Committee has for sale two 900-KW. D.C. generators, 440 to 550 volts, coupled direct to six-cylinder compound engines, also a motor-driven boiler feed pump, and a high-pressure steam feed water-heater. Tenders by February 20th. Particulars are given in our advertisement pages to-day.

The businesses and premises of Messrs. W. Bryden & Son, electrical engineers, &c., of Edinburgh and Glasgow, are to be sold, together or separately. Particulars are given in our advertisement pages to-day.

The Position of Engineering Trade in Canada.—We learn from a correspondent that the war has had a most disastrous effect upon all Canadian business, and especially upon engineering developments. A large number of contracts of all descriptions that were in progress before the war were immediately suspended when hostilities began, and they will not be proceeded with until after the winter. The manager of one engineering works in Canada said a few weeks ago that whereas their "wages" and "materials purchased" accounts in normal times averaged from $90 000 to $100,000 per month, at the present time these accounts were less than $4 000 per month! As it is of course impossible to reduce establishment charges in proportion to the turn-over, this means that engineering businesses are being carried on at a heavy loss at the present time. Notwithstanding the present depressing conditions, however, everyone is stated to be confident that Canada will be the first country to recover at the close of the war, and as there is a very strong Imperialistic tendency resulting from the war, there should be a great increase in British trade. Our correspondent holds that there never was a time when the prospect for British manufacturers capturing a large portion of the Canadian trade was brighter than it is at present, and it is hoped that our manufacturing friends at home will not fail to seize the opportunity.

We learn that the Canadian British Engineering Co, Ltd., of Winnipeg, of which Mr. Leonard Andrews is the managing director, has taken advantage of the slack time to move into new premises (85, Lombard Street). The company now has between 6,000 and 7,000 ft. of warehouse space all on the ground floor, with excellent offices on the second floor; also means of unloading machinery from a railway siding directly into the building. The company also has the use of a good yard space. One of the features of the new building is an engineering showroom with about 1,000 sq. ft. of floor space, of solid concrete and tiled floor. This enables the company to show machinery in motion, which was not possible in the old premises. This showroom has been fitted up as a permanent exhibition of British machinery in motion. Shortly before Christmas an opening week was held, demonstrations being given twice a day throughout the week. This exhibition was visited by about 200 visitors, including many Government and city officials, consulting engineers, architects, and local business men. Mr. Hamilton Wickes, the British Trade Commissioner, who happened to be in Winnipeg during the week, was also a visitor to the exhibition. The keenest interest was shown in the company's demonstrations, and visitors were practically unanimous in their congratulations upon this method of introducing British machinery. Inquiries are being received daily as the direct result of this exhibition, and when trade revives the Canadian British Co. expects to do quite a big business in the sale of British-made appliances. It is Mr. Leonard Andrews's idea, as stated above, to run this showroom as a permanent exhibition of British-made appliances, changing the exhibit from time to time so as to keep the interest in it alive. It may be that manufacturers at home who have specialities they want to introduce into the Canadian market will feel disposed to take advantage of this opportunity and send out appliances for exhibition. The cost of running such an exhibition is very heavy, and only those appliances can be shown which can be handled with advantage.

Bankruptcy Proceedings.—Albert Whiteley, electrical and mechanical engineer, Tudno Works, Tudno Street, Llandudno, Carnarvon.—The first meeting of creditors was held at Chester last week, when the statement of affairs showed liabilities amounting to £476, and assets estimated to realise £163 net, the estate disclosing a deficiency of £312. The failure of the debtor was due to want of capital, loss of money in former partnership, and giving long credit. It was decided to leave the matter in the hands of the Official Receiver.

Jas. W. & Tom W. Tattersall (Tattersall & Tattersall), electrical engineers, Kimberley Road, Willesden Lane, N.W.—Receiving order made February 1st on debtors' own petition. First meeting February 12th; public examination March 16th; both at Carey Street, W.C.

Meldrum Bros., Ltd, Timperley, Manchester.—A third and final dividend of 1s. 8¼d. was payable on February 8th at 3, York Street, Manchester.

Map.—Messrs. Edward Stanford, Ltd., of Long Acre, W.C., have issued, as usual, a coloured map (2s. sheet, 4s. in case), showing the proposed railways, tramways, and other schemes affecting London, in the Parliamentary Bills deposited.

Water-Tube Boilers.—The Stirling Boiler Co., Ltd., state that, as far as water-tube boilers are concerned, business has become exceedingly lively since the beginning of the year. The following are among the more important repeat orders received by them:—

One boiler for the Newcastle and District Electric Lighting Co., Ltd.
Two boilers for the Admiralty for Portsmouth Dockyard.
Four boilers for the Corporation of Huddersfield.
Five boilers for a large firm of ordnance makers in the North, fulfilling contracts for munitions of war.

Heavy Machines in Germany. — The syndicate of makers of manufactures in the heavy electrical branches, to which almost all the large groups and works belong, has been provisionally prolonged until the end of March. This will enable further time to be gained for negotiations for the renewal of the combination which would otherwise have come to an end at the close of 1914.

Deed of Assignment.—R. H. Clampett, electrical engineer, Manchester.—Claims must be sent in by February 20th, to the trustee, Mr. W. Kenyon, 41, Corporation Street, Manchester.

Catalogues and Calendars.—From Messrs. Hart and Co., of Bonnington Works, Newhaven Road, Edinburgh, we have received an art calendar for 1915. It consists of monthly cards each of which contains a charming reproduction from original water colours, showing various views of the building of the Panama Canal.

Messrs E. Brook, Ltd., Colne Road, Huddersfield.—February stock list of electric motors.

The General Electric Co., Ltd, 67, Queen Victoria Street, London, E.C.—Leaflet X 1,850, giving illustrated particulars and prices of "Salford" circuit breakers. Also an illustrated and priced leaflet of the E.V.C. standard electric sign for indicating vehicle charging stations.

Messrs. Isaac Storey & Sons, Ltd., Empress Foundry, Cornbrook, Manchester.—40-page excellently illustrated and fully descriptive catalogue of the Scott patent air compressors. Dimensions, prices, and code-words are tabulated.

Messrs. Ley's Malleable Castings Co., Ltd., Derby.—60-page illustrated catalogue of American and English "Blackheart" malleable castings. The history of the Ley's company and particulars of the different departments are given.

Trade Announcements.—New premises at 31, Silver Street, Stockton-on-Tees, have been opened by Messrs. R. Pickersgill & Son, Ltd., electrical engineers, &c.

Messrs. Tredegar, of 53, Victoria Street, S.W., recently converted their business into a limited liability company, with the title of Tredegar's, Ltd., in order to give the staff a personal interest and to cope with increased business. Mr. H. A. Bartlett and Mr. G. F. A. Norman will be governing director and director respectively.

The Anglo Engineering Co., Ltd, has removed to larger premises at 6 and 7, Gough Square, Fleet Street, London, E.C. New telephone number: Holborn 5923.

The manufacturing branch of Houghtons, Ltd., hitherto carried on at the Ensign Works, Walthamstow, under the title of Houghtons, Ltd. (Spratt Bros.' Branch) has been amalgamated with the factory of W. Butcher & Sons, Ltd., and formed into a separate company known as the Houghton-Butcher Manufacturing Co., Ltd. The management of the factories remains as hitherto. The new company has taken over all the contracts, assets and liabilities of the amalgamated factories.

Russian Trade.—The American Consul at Moscow reports that three societies have recently been founded with the economic development of Russia in view: For Russia, The Economic Revival of Russia, and the Russian Trade and Industry Union for the Development of Domestic and Foreign Trade; and the Moscow Merchants' Society has appointed a Special Committee for the same purpose. The Russian Trade and Industry Union will supply information to merchants with regard to foreign markets, will conduct sales and purchases on a commission basis, and will organise throughout the Empire trade and industrial museums and exhibits of samples.

Liquidations and Dissolutions.—The Miner's Lamp Electric Lighting Co., Ltd.—A meeting will be held at 42, Spring Gardens, Manchester, on March 10th, to hear an account of the winding up from the liquidator, Mr. James Blakey.

The Westminster Lighting, Heating and Ventilating Co., Ltd.—A meeting of creditors is called for February 22nd, at 14, Old Jewry Chambers, E.C.

Harry Wittusen & Co., glass merchants, 24, Thavies Inn, E.C. Messrs. E. Oakley and H. Wittusen have dissolved partnership.

Exhibition of Industrial Furnaces.—On Monday last Prof. J. O. Arnold, of Sheffield University Applied Science Department, opened an Exhibition of Industrial Gas-heated Furnaces, which will be on view until March 6th. The Exhibition consists of the products of the Brayshaw Furnaces and Tools, Ltd., of Manchester, and includes gas-heated furnaces for annealing, hardening, and tempering all classes of steel up to the hardest, and small tools. There is in connection with the furnaces an installation of electric pyrometers, supplied by the Cambridge Scientific Instrument Co., Ltd.

LIGHTING and POWER NOTES.

Antrim.—The C.C. has granted permission to Messrs. J. Densmore & Sons to erect an overhead cable for power supply from Greenfield to Oldgreen.

Ballymena.—Workhouse Lighting.—The B. of G. on the report of the electrical engineer has decided to install the electric light at the old infirmary.

Batley.—The plant ordered for the extension of the electricity works a year ago, which includes a 1,250-kw. Ljungstrom turbine set, has been requisitioned by the Admiralty for installation at one of the naval bases. This machinery, as also a similar turbine set for the Kensington and Notting Hill Co., and a rotary converter for the Kettering Council, was requisitioned at the Brush Co.'s works, where it has been constructed.

Beaumaris.—E.L. Scheme.—The Council has decided to request Mr. Price White to advise it on the proposed scheme for the electric lighting of the borough for municipal and general purposes.

Blackburn.—The borough electrical engineer is to proceed with the work of laying cable to the new electricity substation at Mill Hill.

Boroughbridge.—E.L. Scheme.—The question of introducing electric light into the town and Aldborough, at a cost of £1,200-£1,500, on lines indicated by Messrs. Best & Pullan, is to be discussed at a general parish meeting.

Bradford.—The Electricity Committee is fitting up a stand at the Belgian Village and Exhibition to be held in the Manningham Lane Rink.

In connection with the various Bills in Parliament during the 1915 Session, the Finance and General Purposes Committee has instructed the town clerk to seek, if possible, protection of the Corporation's interests which would be affected by the Keighley Electricity Order; to present a petition against the Yorkshire Electric Power Bill; and to obtain a protective clause in the Halifax Corporation Bill securing that omnibuses shall not be run along Bradford's tramway routes.

Canada.—According to a Government engineer's report, no less than 400,000 H.P. can be developed within 80 miles of Winnipeg. It is thought that the production of electrical power on the Winnipeg River will lead to the founding of numerous additional towns along its banks.—*Financier.*

Canterbury. — Restricted Lighting. — Owing to restricted lighting, there has been a saving of £157 in the street lighting account for the last quarter.

Cheriton.—The Folkestone Electricity Supply Co. has applied for the consent of the U.D.C. to a B. of T. order empowering it to supply current outside its prescribed area, and in the Council's district. The company has also informed the Council that it was possible it would enter into a contract with the War Office to supply current to the hut encampment on St Martin's Plain.

Dartford.—The U.D.C. has decided to supply free current to premises occupied by Belgian refugees, and to allow a rebate of two-thirds of the charge for current used at the club of the National Reserve Guard.

Darwen. — Restricted Lighting. — Owing to the scarcity of coal the General Purposes Committee has decided to curtail the lighting of the street lamps, with the exception of the main thoroughfare.

Doncaster.—Three-Phase Plant Extension.—The alterations and additions at the electricity works have now been completed. The new plant comprises a 1,000-KW. Willans-Siemens turbo-alternator, one 600-KW. and one 350-KW. Westinghouse rotary and H.T. switchgear. The installation will generate three-phase current at 3,300 volts, and sub-stations are erected, or are in course of erection, at Bentley, Hexthorpe and Balby for distribution purposes. The work of installation was carried out by the Corporation's own staff. The extensions cost about £21,000, and constitute part of a larger scheme which has been drawn up by the Corporation electrical engineer (Mr. E. S. Rayner), and will be continued when necessary.

Dover.—Plant Extensions.—Additional plant is to be provided at the Corporation electricity works, at an estimated outlay of £6,000. It is proposed to take out two sets of 75 and 178 KW., and replace them with a 1,000-KW. turbine set.

The B. of G. has under consideration a scheme for new laundry, cooking and heating plant at the workhouse, with provision for E.L. It is proposed to install a duplicate E.L. plant, with batteries of 100 cells, for 400 lamps, the estimated cost of this portion of the scheme being £1,900.

Dukinfield.—Sewage Works Lighting, &c.—The T.C. has decided to offer no objection to a proposal of the Ashton Corporation to light the sewage disposal works at Plantation Farm (which is in the Dukinfield area), and to drive a pump there by electricity obtained from the Ashton works.

Dundee.—The Dundee and Forfar Courthouse Committee has decided to install the electric light throughout the Courthouse.

Eastbourne.—New Plant.—The T.C. has referred back to the Committee the recommendation for the purchase of a 1,250-KW. "Ljungstrom" turbo-alternator and condensing plant, at a cost of £5,085.

Elland.—The Electricity Committee has decided to reduce the price of current supplied to cinematograph lanterns to 2½d. per unit.

Gillingham (Kent).—Loan Sanction.—The T.C. has received from the L.G.B., sanction to a loan of £6,800 for extensions to mains and services, and of this £6,000 is to be taken up at the present time.

Glossop.—The T.C. has decided, in order to protect its own interests, to oppose the Bill of the Stalybridge Joint Tramways and Electricity Board, which includes powers to purchase the local Urban Electric Supply Co.'s undertaking.

Hendon. — Workhouse Lighting. — The Hendon Electric Supply Co. has offered to enter into a contract for a period of five years for the supply of current for lighting and power to the workhouse at £2 10s. per KW. per quarter, and ½d. per unit, if the Board will permit the company to run a low-pressure main from the transformer in the main road in order to supply consumers in the Burnt Oak area. The Sub-Committee of the B. of G. recommends the acceptance of the offer, as the annual charge would be £150, as compared with the estimated present cost of £259, and the scheme would reduce the excessive heat in the laundry, and result in considerable saving in cleansing and decoration, and possible reduction in coal consumption. The Guardians have adopted the recommendation, and tenders are to be invited for the work.

Henley.—The R.D.C. has decided to support the Reading Electric Supply Co.'s application for powers for an extension of the area of supply.

Holywell. — Workhouse Lighting. — The E.L. installation at the workhouse, carried out by Messrs. E. M. Evans and Co., of Manchester, under the supervision of Mr. A. J. Leigh, electrical engineer, at a cost of £727, has been completed.

India.—Tata Scheme.—On Monday the Governor of Bombay switched on power from the Tata hydro-electric scheme. The technical features of the scheme were described and illustrated in our issue of January 16th, 1914.

Kintore.—Exhibition.—An exhibition and demonstration of electrical cooking and heating appliances has been given in the power station at Kintore by Messrs. T. C. Smith & Co., of Aberdeen.

Leeds.—Loan Sanctions.—At a meeting of the City Council, it was reported that the L.G.B. had sanctioned the borrowing of a further instalment of the £200,000 loan for the extension of the Whitehall Road electricity works. It was stated that in September, 1912, the Council threw out a scheme involving an expenditure of £595,000, the loan to be spread over 15 years, but since that date £265,821 in loans had been sanctioned for the department, and two further loan applications were before the Board which would bring the sanctioned expenditure up to £384,000. A resolution has been adopted that the Gas and Tramways and Electricity Committees be directed each to appoint four members to form a joint Sub-Committee whose duties shall be to consider and report to the full Committee from time to time on all questions relative to the scale of gas and electricity to consumers, with a view of preventing and avoiding overlapping and competition in the sale of those commodities.

Littleborough.—Supply in Bulk.—An agreement has been formally entered into between the Rochdale Corporation and the U.D.C. in connection with the supply of electricity in bulk.

Liverpool.—Docks Electric Plant.—The Mersey Docks and Harbour Board has decided to provide an electrically-driven dust extracting plant in the bandalleys, &c., of the Waterloo grain warehouses, and to substitute electric light for the existing gas jets, at a total estimated cost of £3,200.

London.—Hackney.—The Electricity Committee has considered the electrical engineer's reports as to the desirability of linking up the electricity undertaking with that of the Poplar B.C. The result of linking up would be that the works belonging to Stepney, Shoreditch, Poplar and Hackney would be interconnected and able to supply each other in case of need; also it would be possible under the proposed conditions for one undertaking to supply the others from 12 o'clock midnight to 6 o'clock a.m., so that the necessity for running any works on a light and uneconomical load would be entirely avoided.

Several circumstances in the past have prevented the Hackney and Poplar undertakings from being interconnected. Hackney had no plant of a type that could be run in parallel with Poplar; the cost of interlinking the mains would have been very great; and Poplar insisted upon heavy fixed charges being paid whether any units were taken or not.

The first difficulty has been overcome by the installation of plant suitable for running in parallel with Poplar, the laying of E.H.T. ring mains, which can be looped into Poplar from the junction of Wick and Sidney Roads, has removed the second difficulty, and the third difficulty has been overcome, as Poplar is now willing to give and take a supply with Hackney at a small charge per unit, without any heavy annual fixed charges.

The Committee recommends that steps be taken to prepare a draft agreement containing the following conditions:—

1. Poplar to lay and maintain two 0·15 three-core, 11,000-volt standard paper-insulated copper-shielded and lead-covered cables, with pilot and telephone cable from the Northern Poplar sub-station to the Poplar-Hackney boundary in Cadogan Terrace.

2. Hackney to lay similar cables, forming a loop of the ring main from the pit at the junction of Wick Road and Cassland Road to the Poplar-Hackney boundary in Cadogan Terrace.

3. The cost of the necessary switchgear to be provided for the purposes of the linking-up mains in the Poplar Northern sub-station to be borne equally by Hackney and Poplar.

4. Either party to have the use of the other party's natural reserve plant without the payment of any fixed charges.

5. In the event of either party installing reserve plant for stand-by or other purposes at the request of the other party, the first-named party to receive payment of such proportion of the

loan charges on the capital expenditure, and for such period as may be mutually agreed, or, failing agreement, the sum and period to be fixed by arbitration.

6. Either party to supply energy to the other party (subject to such limitation as is defined in Clause 4) at a price per unit measured at the supplier's switchboard, of 0·25d.

7. So far as practical, each party shall give to the other, equal supplies of energy, and only excess supplies shall be subject to be paid for in cash.

8. The period of the agreement to be for 20 years, during which time the charges may be revised by mutual agreement at the end of each fifth year.

The cost of the necessary mains and switchgear for effecting the link is estimated at £2,720.

BATTERSEA.—The Electricity Committee reports that owing to the increasing demand for the supply of electrical energy in the Nine Elms district, it will be necessary to extend its plant, and recommends the adoption of the scheme of the electrical engineer for two rotary converters of 500-KW. each, and one of 1,000-KW., together with the necessary switchgear and transformers, at an estimated cost of £8,750, and for duplicate E.H.T. feeders to be drawn into the existing ducts between the electricity generating station and a point in New Road, at an estimated cost of £7,000. The Council is recommended by the Finance Committee to make application to the L.C.C. for sanction to a loan of £15,750 to carry out the work. The Committee also recommends that negotiations be opened with the Fulham B.C. with a view to linking up the supplies of Battersea and Fulham under the London Electric Supply Act, 1908.

DEPTFORD.—In order to comply with the regulations of the L.C.C. as to the condition of the electrical installation at the borough hall, the Council is obtaining expert advice.

FULHAM.—The Electricity Committee reports that the demands for energy for consumers in the De Morgan and Townmead Roads area are increasing, and recommends that the Stephendale and Townmead Road sub-stations be connected up, and that the necessary cable high and low-tension switchgear, and two 100-KW. transformers be obtained at a cost of £570.

ST. PANCRAS.—The chief electrical engineer reports a difficulty in obtaining supplies of coal; he has communicated with the railway company, the War Office, and the Railway Executive Committee, pointing out that unless the supply is improved the circumstances may be serious having regard to the fact that the factories in the borough, many of which are engaged in Government work, may have to shut down. The difficulty seems to have arisen owing to supplies not coming through from the collieries specified in the contract.

In reply to the B.C.'s application for a loan of £22,530 for boilers at King's Road generating station and £8,970 for mains, house services, meters and arc lamps, the L.C.C. states that the Parliamentary power to lend money to Metropolitan B.C.'s in the current financial year is nearly exhausted, and that the Council can only make an advance of £10,000 to the B.C. at the present time.

The Finance Committee has accepted the loan of £10,000, and will report later as to the steps taken to obtain the balance of the loan.

L.C.C.—The Finance Committee recommends the sanction of the Council to the application of the Hammersmith B.C. to borrow £10,000 for purposes of the electricity undertaking, viz., £416 for buildings, £3,449 for mains, £1,535 for transformers, switch panels, &c., £2,980 for house services and £1,620 for meters.

According to the *Daily News and Leader*, the L.C.C. has given notice of the withdrawal of its Electric Supply Bill, but a private Bill of a similar kind proposing to form a company for electric supply in London was put down for Thursday. This, it was stated, will be opposed by the County Council and by members on both sides of the House.

The *Standard*, of last Friday, said that the Bill would not be withdrawn, but the application for first reading would be postponed, with a view to reconsideration of the vote.

RESTRICTED LIGHTING.—It is somewhat astonishing to find in these days of darkness that complaints have been made against the brilliantly lighted windows of the Houses of Parliament. Possibly the presence of so many "shining lights" within its portals, and a natural antipathy to hiding them, may account for the trouble.

Mottram-in-Longdendale.—The U.D.C. has decided to oppose the Bill of the Stalybridge, Hyde, Mossley and Dukinfield Tramways and Electricity Board, by which further electricity powers are sought.

Newcastle Power Schemes.—Reference has been made on many occasions in these columns to the development of electrical power distribution on the North-East Coast, more especially to the several power stations which have been built in the neighbourhood by the Newcastle-on-Tyne Electric Supply Co. and its associated companies. Some six and a half years ago, the Supply Co. decided that it would be expedient to construct a coal-fired power station at a point higher up the Tyne, and on the Gateshead side of the river, and it was decided to erect a plant on the banks of the Tyne at Dunston. This station, which has a river frontage of about 900 ft., was put into service some three and a half years ago, and formed the subject of a detailed illustrated article, which appeared in our issue of July 7th, 1911. The Dunston station generates three-phase current at 40 cycles and 6,000 volts. The steam pressure is 200 lb. per sq. in., and the steam is superheated, the total temperature being practically 570° F. The main generating units at present consist of two A.E.G. sets, each of 10,500 H.P., and a Brown-Boveri set of 9,000 H.P., all three running at 1,200 R.P.M. The station was originally laid out to accommodate eventually six generating units, each of 10,000 H.P. continuous capacity and 13,000 maximum capacity, or a total capacity of about 70,000 H.P. In connection with the present extension scheme, an agreement was entered into with the Teams By-Product Co., Ltd., to purchase the available supply of gas from a large battery of Otto-Hilgenstock coke ovens distant 1½ miles from the Dunston power station. This gas is led along the North-Eastern Railway Dunston branch in a 16-in. welded steel pipe, supplied by Messrs. Stewarts & Lloyds, Ltd. The joints were welded *in situ* by the acetylene process. The boiler-house extensions comprise a steel frame building, sheeted in with corrugated iron, 114 ft. long × 75 ft. wide, with two steel chimneys. There are two coal-fired water-tube boilers, each capable of producing continuously 30,000 lb. of steam per hour, with the necessary furnace and fixtures, also stokers and superheaters. In addition, there are four gas-fired water-tube boilers, each capable of dealing continuously with 57,000 cb. ft. of gas per hour, built in two batteries, with the necessary flue fixtures inclusive of gas burner and superheaters. The fuel economisers, one for each boiler, have automatic tube scrapers and dampers, also soot-cleaning gear. Induced draught fans, direct driven by electric motors, deal with the products of combustion from two gas-fired boilers and one coal-fired boiler. There are two feed pumps, each capable of dealing with 200,000 lb. of water per hour at 190 lb. to the square inch, boiler pressure. The coal-handling plant is of the gravity bucket conveyor type, and capable of feeding the coal into the overhead bunkers at the rate of 40 tons per hour. The plant is suitable for receiving coal from two hoppers of 25 tons capacity, each traversed by a railway truck. The overhead bunkers have a capacity of 950 tons. All the boiler-house plant and buildings were contracted for by Messrs. Babcock & Wilcox, Ltd., and the whole of these buildings were placed on a 6 ft. 6 in. reinforced concrete raft supported on 376 40-ft. pitch pine piles, which work was executed by Messrs. Robert McAlpine & Sons, Ltd. The engine room plant extensions consist of a 12,000-KW. turbo-alternator with direct-coupled exciter, the turbine being of Messrs. Richardsons, Westgarth's manufacture, and the alternator by Messrs. Brown, Boveri. The surface-condensing plant consists of a Contraflo surface condenser capable of dealing with 141,600 lb. of steam per hour. The turbine is of the impulse-reaction type, designed to run at a speed of 1,200 R.P.M. with steam at a pressure of 190 lb. per sq. in., and at a temperature of 600° F, with a vacuum of 29-in. mercury. Though the normal and most economical load is 12,000 KW., the machine is capable of 50 per cent. overload. The alternator has a normal capacity of 12,000 KW. at a power factor of 7 lagging and 5,750 volts, 40 periods. It will, however, take overloads up to 13,200 KW. steady, and 15,000 KW. for 60 minutes, equivalent to 21,400 KVA. The necessary condensing plant has also been supplied by Messrs. Richardsons, Westgarth, and the whole of the installation has been built and started up under the supervision of Messrs. Merz & McLellan, the consulting engineers to the Supply Co.

Nottingham. — PROPOSED LOAN. — The T.C. has adopted the recommendation of the Electricity Committee to borrow £20,000 for the extension of the electricity mains and services.

Nuneaton.—Current for lighting halls used for drill purposes is to be supplied by the T.C. free of charge. The Electricity Committee is still considering the question of giving a supply of current to the Stockingford district.

Oldham.—The T.C. has decided to oppose the Stalybridge Joint Board's Bill, which seeks additional facilities and extension of area for electricity supply.

Ormskirk.—The U.D.C. has decided to oppose the Gas and Electricity Bill promoted by the Ormskirk Gas Co. A previous resolution to the same effect was declared invalid.

Perth.—NEW TURBINE PLANT.—The Electricity Committee recommends the T.C. to apply for sanction to a loan of £4,000 for new plant, including a new turbo-generator, at the electricity works.

Portaferry (Co. Down).—An official inquiry was held last week into the Downpatrick R.D.C.'s application for powers for the electric lighting of the town.

Reading.—The T.C. has decided to oppose the Reading and District Electric Supply Co.'s Bill to extend the area of supply in order to include Henley-on-Thames, as the Council considers that the extension would not prove sufficiently remunerative, and that the time at which the company's charges for lighting and power could be reduced will be postponed.

St. Anne's (Lancs.).—The U.D.C. has decided to supply electric light free to local training corps.

Sheffield.—The City Council has been recommended to adopt electricity for lighting the Fulwood Park Estate. It is proposed to put up a temporary installation for lighting Club Mill Lane, consisting of 20 wooden poles each fitted with a 60-watt (50-C.P.) metal filament-lamp and overhead cable. The Electric Supply Committee has decided to charge all hospitals for current consumed for lighting purposes at 4d. per unit less a rebate of 33⅓ per cent. A similar rate is to be offered to the Guardians for all lighting at the Firvale workhouse buildings.

Stretford.—Public Lighting.—The U.D.C. has approved of the extension of the scheme for improved lighting of Chester Road. The lighting of the thoroughfare by half-watt lamps previously authorised is now completed.

As the lighting battery at Longford Hall will shortly require renewal, the electrical engineer, together with the surveyor, is to report upon the question of supplying current from the public mains.

The Electricity Committee proposes to re-appoint Mr. Thomas L. Miller as consulting engineer at a fee of 25 guineas.

Southport.—Restricted Lighting.—The electrical and gas engineers have been instructed to reduce the illumination of all lamps by darkening the tops and parts of the sides. The electrical engineer is to act on the instructions of the military authorities as to cutting off the supply if and when necessary.

Torquay.—The Electricity Committee reports that there was an increase of 189,959 A.C. units sold during the past year, while there was a decrease of 25,000 D.C. units.

Wakefield.—New Loans.—In connection with the electricity undertaking, application is to be made to the L.G.B. for sanction to borrow £3,000 for mains, £500 for sub-stations, and £500 for transformers. Sugar Lane is to be lighted by electricity.

The ventilation of the public library is to be improved by the provision of an electric motor and fan, at a cost of £65.

The Stanley Electric Lighting Provisional Order is to be opposed.

Wigan.—Proposed Loan.—Application is to be made for sanction to the borrowing of money for switchgear and a transformer.

Wimbledon.—The Electricity Committee reports that a supply of electrical energy has been given to the factory of Messrs. Hugh Stevenson & Son, at 1d. per unit, with a minimum consumption of 20,000 units per annum, the supply to be taken for one year certain.

Owing to the difficulty in obtaining delivery of coal at the generating station, consumers were warned that the Council might be compelled to restrict the output of electricity for all purposes at any time after 12 o'clock noon on February 3rd. On inquiry, on Tuesday last, we were informed that the difficulty had been removed.

Windermere.—Public Lighting.—The U.D.C. has invited the Electricity Supply Co. to quote terms for the public lighting of the district known as Craig Walk.

Worcester.—L.G.B. Inquiry.—Mr. H. R. Hooper has held an inquiry into an application to borrow sums of £5,250, £1,975 and £850 for purposes of the electricity undertaking. He criticised the over expenditure on loans, and finally adjourned the inquiry with a view to obtaining amended financial returns.

Yorkshire Electric Power Bill.—A conference of local authorities affected by the provisions of the Yorkshire Electric Power Co.'s Parliamentary Bill, was held at Wakefield last week, under the chairmanship of the Hon. C. G. Milnes-Gaskell, when a resolution was adopted that, failing satisfactory amendments to the Bill, it should be opposed by the Urban and Rural Councils of the West Riding, and that the Executive Committee of the District Councils' Association be requested to co-operate with the County Council for the purpose of making such opposition effective. In a discussion with the representatives of the Power Co. which followed, it was stated that 33 out of the 84 Councils affected, approved of the proposals and supported the Bill. Mr. A. G. Lupton, chairman of the company, said that if any local authority wished to be cut out of the Bill, and such authority passed a resolution accordingly, they would be left out and cut off from all benefits that the company wished to bestow upon them. The Burley-in-Whafedale District Council, have taken advantage of this last statement, and have passed a resolution requesting to be cut out of the Bill, failing which they will oppose it in accordance with the above-mentioned resolution. The New Mill District Council have also passed a resolution asking to be left out of the Bill altogether. We also note that the Skipton R.D.C. and Silsden U.D.C. are opposing.

TRAMWAY and RAILWAY NOTES.

Aberdeen.—P.A.Y.E. Cars.—The proposal to abolish the P.A.Y.E. cars on the Corporation tramways came before the T.C. last week, and after three hours' discussion a decision was deferred pending further consideration by the Tramways Committee.

Barnes.—Electric Dust Vans.—After trials of Baker and Edison dust vans, the Public Health Committee recommends that four such vans with Edison batteries be purchased, and that steps be taken to obtain a loan for the purpose.

B. of T. Tramways Statistics.—The annual return of the Board of Trade respecting the tramways, light railways and railless vehicle undertakings of the United Kingdom, for the period ending March 31st last, shows that 2,700 miles of route were open, and that 3,426,473,192 passengers were carried, 354,379,672 miles being run—these figures being in excess of those for the year 1912-13. The percentage of working expenditure to gross receipts increased from 62·6 to 64·3, while the average receipts per passenger decreased from 1·065d. to 1·053d. The total capital expenditure amounted to £80,977,838. Some 4 per cent. of the route mileage is not worked by electric traction.

Of the 279 undertakings, 171 belong to local authorities and 108 to companies or other parties. The net receipts of municipal undertakings amounted to £4,071,610 for the year; £1,218,299 was required for interest or dividends, £120,039 for rent of leased lines, and £1,371,263 for reduction of debt; £589,886 was paid in relief of rates and £711,217 was carried to reserve and renewals. Three local authorities and five companies show an excess of working expenditure over gross receipts. In 26 cases it was necessary to seek aid from the rates to meet some part of the charges, including interest and debt charges.

Of 26 railless traction undertakings authorised, 21 belong to local authorities and 5 to companies. Altogether 131 miles have been authorised, and 21 miles were worked, all by local authorities.

Municipal undertakings carried 2,696,759,064 passengers, worked 262,675,163 car-miles, and were credited with the use of 499,809,146 KW.-hours. The return shows that 406 horses were still in use, these, however, being mainly on the L.C.C. routes, which are now being electrified; Northampton and Morecambe being the only other places where horse traction still survived in municipal service.

The company undertakings carried 729,714,128 passengers, worked 91,704,509 car-miles, and were credited with the use of 130,052,873 KW.-hours. They also employed 550 horses in 11 undertakings, and 29 locomotives in 8 undertakings. On all lines, 13,196 electric cars were in use and 462 non-electric cars.

As regards railless traction undertakings, Brighton and Hove have the largest authorised capital expenditure (£99,000 and £88,000), while Rotherham (£48,000), and Chesterfield (£42,000), also figure prominently. Two company undertakings in North Yorkshire and Monmouthshire have an authorised capital of £130,000 between them. The returns for English railless traction undertakings working show that 1,807,222 passengers were carried, 369,691 miles were run, and 370,532 KW.-hours used. Working expenditure amounted to £10,935 and net receipts to £3,143. The only undertaking operating outside England was at Dundee, where 152,919 passengers were carried and 40,366 miles run, the receipts being £314 less than the working expenditure, £776.

Bolivia.—Tramway Scheme.—A scheme for the construction of an electric tramway from La Paz to the Yungas Districts has been reported on favourably, and will in all probability be approved by the House of Legislature in due course. The territory through which the proposed line is to pass is probably the richest agricultural part of the Department of La Paz under actual cultivation. The roads leading thither from La Paz are good, and from a short distance from the city to the farthest distances travelled enormous water power is to be found to supply not only the proposed line, but any number of industries. It is almost certain that an electric tramway once constructed would cost very little to operate. The maximum cost of the line is calculated as £500,000, and the work would be directed by the Public Works Department of the Bolivian Government, its cost being defrayed from the Treasury of the Department of La Paz. Surveys have been made by the Bolivia Railway Co. and by the Public Works Office. The United States Minister states that there might be an opportunity for a manufacturer, who was sufficiently interested, to arrange with the Government to construct the tramway on his own account.

Bradford.—The Corporation Tramways Committee has decided to remove the exisiting car-shed at Bolton before the end of the present year, and has instructed the city architect, in conference with the general manager, to proceed with the preparation of plans for the erection of a new car depôt. A special Sub-Committee has been appointed to inquire into the whole question of tramway track construction and maintenance.

Bury.—The extensions of the Corporation tramways to the borough boundary at Jericho, and to the New Inn at Walmersley, have now been completed, and are awaiting inspection by an officer of the B. of T.

Clayton-le-Moors.—The Council has decided to object to the granting of an extension of time for the construction of the Clayton Light Railway.

Doncaster.—Tramway Extensions.—The extension of the tramways system from Balby to Warmsworth was inspected on the 4th inst. on behalf of the B. of T.

Four additional cars have been ordered, and borrowing powers are being sought by the T.C. for six others.

London.—L.C.C.—The total traffic receipts on the Council's tramways from April 1st, 1914, to January 27th, 1915, were £1,906,270 from lines worked by electric traction, and £9,164 from horse traction, a total of £1,915,434. The receipts for the corresponding period of the previous year under the same headings were £1,803,109, £18,635, and £1,821,744 respectively.

Merthyr Tydfil.—Assessment Troubles.—The Merthyr Electric Traction Co. has appealed against the assessment of its undertaking, fixed at £2,571 in the borough and £86 in Cefn. In 1905 the rateable value was fixed at 6 per cent. on the gross receipts, with an agreed sliding scale basis, and in 1913, it was contended, the rateable value had risen to 11 per cent. The company considers that £1,600 should be the proper rating for Merthyr, and that on a give-and-take principle it should not exceed £1,780. The Assessment Committee has decided to ascertain from the valuers the basis on which they arrived at their assessment.

London.—The Metropolitan Railway, which has been reconstructing its country extension with four tracks, is to provide a new fast service of trains on those lines from May 1st.

Nelson.—The tramways continue to suffer as a result of the war. It was reported that for the period commencing December 12th, and ending January 9th, 216,236 passengers had been carried, against 279,437 for the corresponding period a year ago, the receipts being down to the extent of £206.

South Africa.—Electrification of Railways.—At a meeting of the South African I.E.E., Mr. F. W. Mills, electrical superintendent S.A. Railways, stated that electrification of the suburban lines at Cape Town had been considered and reported upon, and that he had no doubt that in the near future the electrification of certain sections of the line would become one of the live questions, as both Mr. Hoy and the Railway Board were keenly interested. He considered that under certain conditions it would pay to electrify the railways, and with the assistance of the Victoria Falls Co. he considered that electrification was at hand if only a low price for power could be obtained.

South Shields.—A Tramway Proposal.—The T.C. last week agreed to the Tramways Committee's proposal to confer with the Jarrow Corporation, and to enter into negotiations with the Jarrow Tramways Co. with the view to taking over the company's undertaking.

Walsall.—The Finance Committee of the T.C. has decided to transfer from the tramways account a further sum of £1,000 towards the relief of the rates during the year ending March 31st next.

The Daimler Co. having offered six motor-omnibuses at the price of £5,369 complete, the Tramways Committee has purchased the same, and recommends the Council to enter into a new contract therefor, the old contract for six vehicles to remain in force, and to be fulfilled as soon as circumstances enable the company to deliver the vehicles.

Wigan.—The Tramways Committee has decided to carry out alterations to the tramways track in Standishgate and Crompton Street, at an estimated cost of £1,126.

TELEGRAPH and TELEPHONE NOTES.

A Real Wireless Antenna.—According to a letter published in the *Scotsman*, from a Scot resident in Buenos Ayres, there were "Clandestine wireless installations all over the city, which could reach a strong station on a German 'estancia' down south, which, in its turn, used to communicate steamer sailings, &c., to the German commerce destroyers. . . . When the Argentine Government got after the clandestine installations the German Electric Co. used the smoke of their big chimney instead of antennæ, as the smoke contains enough carbon to act as conductor for the Hertzian waves. What do you say to that?"

This seems to go one better than Mr. Campbell Swinton's bedstead receiver.

Automatic Telephones.—It is proposed to provide all the telephone exchanges in the Sheffield area with full automatic equipment, and to replace the present Liverpool Central Exchange by a semi-automatic exchange in the "Bank" building.

China.—The United States Consul at Hankow states that last July a new C.B. installation, with American equipment, was opened at Changsha. It has a present capacity of 1,000 local lines and 40 toll or long-distance lines, and is arranged for an ultimate capacity of 3,000 lines. It replaces one of the magneto type, equipped for 350 lines. The Chinese have now thoroughly realised the advantages of the telephone for commercial as well as Government uses, and are beginning to recognise that telephone systems, properly designed and managed, will yield profits, so that it will be easier to interest local capital in such schemes.

Illicit Wireless Installations.—At Enfield Police Court on Monday Stanley Warren White, a wireless student, was charged on remand with having in his possession, without the written permission of the Postmaster-General, a complete wireless installation. Experts stated that the apparatus was capable of sending and receiving messages from eight to ten miles. The defence was that the apparatus was really a toy. The magistrate imposed a fine of £7 and costs, and the wireless apparatus was ordered to be detained by the Post Office authorities until after the war.

Mr. Hamilton Bell, a draper, was fined £20 by the Castle Eden magistrates on Saturday for being in unlawful possession of a wireless apparatus at Blackhalls, on the Durham Coast.

Long-Distance Telephony.—The trans-Continental telephone service between New York and San Francisco will be opened for commercial use early next month. The rates will be $20 70 for three minutes and $6.75 for each additional minute. These high rates are justified by the fact that communication between these cities involves the employment of $2,000,000 worth of plant.

New Cable.—The new submarine cable between Nagasaki and Shanghai, the laying of which has been in progress for the last two years, has now been completed and opened for the transmission of messages between Japan and China.

CONTRACTS OPEN and CLOSED.

OPEN.

Aberdare.—March 6th. U.D.C. Twelve months' supply of cables, meters, joint-boxes, &c., lamps, uniforms, tickets and other stores. See "Official Notices" February 5th.

February 19th. Wiring and fittings at the Police Court, for the Glamorgan Quarter Sessions Standing Joint Committee and C.C. Specification from the Architect, County Hall, Cardiff.

Australia.—Brisbane.—March 10th. Motor-generator, power board, &c., for Postmaster-General. See "Official Notices" January 15th.

April 7th. Deputy P.M.G. Wheatstone receivers and transmitters (Schedule 335). High Commissioner for Commonwealth, 72 Victoria Street, S.W.

Melbourne.—March 16th. White Wheatstone receiving tape, for Postmaster-General. See "Official Notices" February 5th.

Bedwas.—March 4th. Electrical goods for 12 months, for the Bedwas Navigation Colliery Co., Ltd. Forms of tender from the Secretary.

Blackburn.—February 13th. Corporation. Twelve months' supply of stores, including a number of electrical items, for the Electricity Committee. See "Official Notices" Jan. 29th.

Bootle.—February 17th. Corporation. Twelve months' supply of cables, meters and electrical stores. Forms of tender from the Borough Electrical Engineer.

Bridlington.—The T.C. has instructed the Borough Electrical Engineer to obtain provisional tenders from six firms for the erection and equipment of a refuse destructor.

Cardiff.—February 22nd. Installation, 750 points, at New Technical Institute, Cathays Park, for the City Council. See "Official Notices" January 22nd.

Dublin.—February 18th. Corporation. Twelve months' supply of arc lamp carbons. See "Official Notices" to-day.

Edinburgh.—The City Council has decided to postpone advertising for contracts for stores for two months, and, in the event of the present conditions continuing into April, to make the contracts then advertised extend, if necessary, over short periods only, instead of 12 months.

Gloucester.—April 1st. Twelve months' supply of stores, for the Electricity and Light Railways Committee. Forms of tender from Mr. F. H. Corson, General Manager, Light Railways Offices, Bristol Road.

Halifax.—February 15th. Corporation. Twelve months' supply of stores, including lighting fittings and electrical accessories, cables, telephone wire, meters, &c. See "Official Notices" January 22nd.

Ilford.—February 23rd. U.D.C. Twelve months' supply of stores for the electricity works. See "Official Notices" February 5th.

Leeds.—February 20th. Corporation. Twelve months' supply of stores, including cable, mains boxes and fittings, jointing and insulating material, electric lamps, fittings, &c., for Electric Lighting Department. See "Official Notices" January 22nd.

February 17th. Electrical work, Hough Lane School, Bramley, for the Education Committee. Education Architect.

February 22nd. Corporation. Twelve months' supply of electrical sundries, for the Tramway Department. Forms of tender from the Tramway Manager.

London.—Islington.—February 24th. B.C. Twelve months' supply of electrical stores. See "Official Notices" February 5th.

St. Pancras.—February 15th. B.C. Arc lamp carbons, for the Electricity Department. See "Official Notices" January 29th.

St. Marylebone.—February 17th. Stores, including meter-boards, casings, &c., cables, box compound and insulating materials, &c., for Electricity Department. See "Official Notices" Jan. 29th.

Wimbledon.—February 22nd. Corporation. Twelve months' supply of stores for the Electricity Department. See "Official Notices" to-day.

Fulham.—February 24th. B.C. Twelve months' supply of electrical stores. See "Official Notices" to-day.

Hammersmith.—February 24th. B.C. Twelve months' supply of general electricity stores. See "Official Notices" to-day.

Battersea.—March 2nd. B.C. Supply of stores for Electricity Department. See "Official Notices" to-day.

Macclesfield.—March 10th. Cheshire County Asylum, Parkside. Electrical goods for one year. Forms of tender and particulars from Mr. Wm. Tingay, Clerk of Asylum.

Manchester.—February 16th. Corporation. Twelve months' supply of stores for the Tramway Department. See "Official Notices" January 29th.

New Zealand.—May 3rd. Electrically-driven turbine pumps of 80,000 and 100,000 gallons capacity per hour, together with direct-coupled motors. Commercial Intelligence Department, Board of Trade, London.

North Bierley.—February 22nd. 800 electric incandescent lamps, for the Guardians. See "Official Notices" to-day.

Portsmouth.—February 16th. Corporation. Six months' supply of stores, for the Tramway Committee. See "Official Notices" February 5th.

Reigate.—February 20th. Corporation. Supply of coal for the electricity works. Particulars from Mr. W. S. Ross, Electrical Engineer.

Rotherham.—February 22nd. Corporation. Two water-tube boilers, automatic mechanical stokers, economisers, superheaters, foundations, steel chimneys, steam valves, steam pipes, induced-draught plants, and all auxiliaries. See "Official Notices" January 29th.

Salford.—February 22nd. Twelve months' stores for the Tramways Department. General Manager, 32, Blackfriars Street.

Spain.—The municipal authorities of Cogeces del Monte (Province of Valladolid) have just invited tenders for the concession for the electric lighting of the town.

Stockton-on-Tees.—February 19th. Corporation. Two 500-kw. rotary converters, transformers and starting apparatus. See "Official Notices" February 5th.

Swindon.—February 17th. Corporation. Four-way and other stoneware conduits, for the Electricity and Tramway Department. See "Official Notices" February 5th.

CLOSED.

Argentina.—The American Consul at Rosario says that the Government has accepted the tender of the Gasmotoren Fabrik Deutz for the installation of motors for electric plants in 11 barracks in the cities of Tucuman, Salta, Jujuy, Corrientes, San Nicolas, Santiago del Estero, Catamarca, Mendoza and Mercedes. Six tenders were received, ranging from $33,118 to $89,166. The Gasmotoren Fabrik Deutz offers to deliver the motors for $33,118, to which amount $2,123 is added for necessary masonry work.

Batley.—The E.L. Committee has accepted the tender of Messrs. Ferranti, Ltd., for 17 meters.

Bradford.—The Corporation Tramways Committee has accepted the tender of Messrs. W. A. Stevens, Ltd., for a 40 H.P. Tilling-Stevens petrol-electric chassis required for a tower wagon, at £672.

Ecuador.—The Guayaquil Electric Light & Power Co., Guayaquil, Ecuador, has placed the following contracts:—

Two 400-B.H.P. Diesel engines.—Hick-Diesel Oil Engines, Ltd.
One 275-kw. alternator and one combined traction and alternator set.—Crompton & Co., Ltd.

Clyde Navigation.—Messrs. Johnson & Phillips, Ltd., have secured an order from the Clyde Navigation for an installation of power cables for Queen's Dock.

Dartford.—The following tenders for coal for the electricity works have been accepted by the U.D.C.:—

John Herd, Son & Co., Ltd.—Yorkshire rough small, 22s. 6d. per ton South Hetton rough small, 5s. per ton above contract price.
Bradbury, Son & Co., Ltd.—Tamworth 1½-in. slack, 16s. 7d.; Gedling 1½-in. slack, 17s. 6d.
Cleeves & Co.—Mid-Cannock 2-in. slack, 17s. 6d.; Kirkby 2-in. slack, 18s. 4d.; Baddesley fine slack, 18s. 1d.
E. J. & W. Goldsmith, Ltd.—Rubbly Culm, 2s. per ton above contract price.
Myers, Rose & Co., Ltd.—Ripley nutty slack, 1¼ in. to 1½ in., 20s.; Gedling coal, 18s.; Mansfield coal, 18s. 9d.

Dorchester.—The County of Dorset Supply Co. has placed a meter contract for the period of 1915-16 with the Electrical Apparatus Co., Ltd.

Dover.—The T.C. has accepted the tender of Messrs. Dick, Kerr & Co., Ltd., for 50 tons of tramway rails (45 ft.), at £8 15s. per ton. Two other tenders, each for 30-ft. rails, were £7 15s. 4d. and £8 8s. per ton respectively.

Keighley.—The tender of Messrs. Drakes, Ltd., Halifax, for new carbonising plant at the gasworks, including electrical power generating plant, has been accepted by the T.C.

London.—Messrs. Napier-Kimber, Ltd., have obtained a contract from the Metropolitan Asylums Board for installing an electrically-driven mincing machine and potato-paring machine at Western Hospital, Fulham.

The London Education Committee has received the following tenders for installing electric light at the Exmouth Street School, St. Pancras:—

H. J. Cash & Co. (accepted)	£349	G. Weston & Sons, Ltd.	£410
A. Hawkins & Sons	355	T. H. Smerdon	412
Alpha Manufacturing Co.	365	Lund Bros. & Co.	414
Johnson, O'Sullivan & Co.	365	Honor Bros.	660
R. H. & J. Pearson, Ltd.	399		

Fulham.—The Electricity Committee reports that Messrs. A. Duckham & Co., Ltd., and Messrs. Wilcox & Co., Ltd., the contractors for lubricating oils, are prepared to renew their contracts on the existing terms for the ensuing year, and recommends that further contracts be entered into with Messrs. A. Duckham & Co., Ltd., for 12 months to March 31st, 1916, for the supply of cylinder oil at 1s. 8d. per gallon, and with Messrs. W. H. Wilcox & Co., Ltd., for the supply of engine oil at 1s. 4d. per gallon, and turbine oil at 1s. 6d. per gallon.

Stepney.—With reference to the Council's orders for carbons, the British Central Electrical Co., Ltd., writes to state that the French Government's prohibition of exports of carbons only prevailed for a few days, and is now removed.

Middleton.—The E.C. has accepted a tender of Mr. G. Hulbert to supply 1,800 tons of coal during the six months commencing March 1st.

Romford.—The B. of G. has accepted the tender of the Private Telephone and Electric Co., Ltd., for the installation of a house telephone service, at £59.

Salford.—The following plant has been obtained for the electricity station, Frederick Road:—

Turbine-driven boiler and feed pump.—G. & J. Weir, Ltd., £235.
Boiler fed water heater.—Isaac Storey & Sons, £78.

Sheffield.—The following tenders have been recommended to the City Council for acceptance:—

Electric Supply Department.

C. A. Parsons & Co.—One turbo-alternator, consisting of steam turbine, condensing plant, alternator and accessories, £31,413.
Abbott & Bannister.—Erection of sub-station, Carr Road, Walkley, £215.
British Electric Transformer Co.—Three 150-K.V.A. transformers, £225.

Water Department.

General Electric Co.—One 40-H.P., one 20-H.P., one 6-H.P., and one 1-H.P. electric motors.

Tramways Department.

Durham, Churchill & Co.—45-H.P. chassis for 'bus, £650.
Hadfield's Steel Foundry Co.—17½ tons of tie-bars.

Ship Lighting.—A contract for Osram lamps has been placed with the General Electric Co., Ltd., by the Bibby Line of steamers, supplanting carbon lamps and other makes of metal-filament lamps. This contract covers an exceedingly large quantity of lamps, and was placed after exhaustive tests.

The lamp contract mentioned under the above heading last week is for the Orient Steam Navigation Co., and not the British India Steam Navigation Co., as mentioned.

Southport.—The tender of the Improved Wood Pavement Co., Ltd., for the repairing of tramway track in Lord Street, at a cost of 13s. per sq. yd., has been accepted.

Torquay.—The T.C. on February 2nd accepted the following tenders:—

Rees Roturbo Co.—Motor-driven sea water pump for generating station, £248.
Herbert Morris, Ltd.—Overhead travelling crane, £185.
T. L. Harding & Sons.—Steelwork for coal transport, £95.
British Thomson-Houston Co., Ltd.—Switchgear, £1,564.

Tunbridge Wells.—The T.C. has, subject to the L.G.B. sanctioning loans, accepted the following tenders:—

Stirling Boiler Co.—Boiler and auxiliary plant, £5,630.
Witting & Partners.—Cooling tower, £1,800, and dismantling the existing tower and rebuilding a new one, £950.

Walsall.—The Tramways Committee has accepted the offer of the Daimler Co., Ltd., to supply six motor-omnibuses in addition to those already contracted for—and which will be delivered as soon as the requirements of the War Office are complied with—at a cost of £5,369.

Warrington.—The Electricity and Tramways Committee has accepted the tender of the Lion Foundry Co. for the supply and erection of tramway shelters.

Watford.—The tender of Messrs. Jackson & Co. has been accepted by the U.D.C., at £220, for repairs to a turbine.

Wigan.—At the T.C. meeting on February 3rd, Alderman Higham stated that the E. L. Committee had rescinded a resolution accepting the tender of a firm for switchgear and a transformer, the discovery having been made that the firm was a German concern. He was pleased to say that an English firm had undertaken to do the work for the same price.

Wolverhampton.—The Electricity Committee has accepted the tender of the Rees Roturbo Co., Ltd., at £165, for two electrically-driven pumps.

FORTHCOMING EVENTS.

Physical Society of London.—Friday, February 12th. At 8 p.m. At Imperial College of Science, South Kensington, S.W. Papers on "The Criterion of Steel Suitable for Permanent Magnets," by Prof. S. P. Thompson, F.R.S.; "A Galvanic Cell which Reverses its Polarity when Illuminated," by Mr. A. A. C. Swinton; "An Investigation on the Photographic Effect on Recoil Atoms," by Messrs. A. B. Wood and A. I. Stevens.

Salford Technical and Engineering Association.—Saturday, February 13th. At 7 p.m. At Royal Technical Institute. Peel Park. Paper on "How Plants Protect Themselves," by Mr. J. E. McDonald. Ladies invited.

Greenock Electrical Society.—Saturday, February 13th. Visit to Royal Technical College, Glasgow.
Thursday, February 18th. At 7.45 p.m. At 21, West Stewart Street. Paper on "Diesel Engine Testing and Running," by Mr. J. Richardson.

North of England Institute of Mining and Mechanical Engineers.—Saturday, February 13th. At 2 p.m. At Memorial Hall, Newcastle-on-Tyne. Various papers will be open for discussion. To be read, paper on "Winding-Engine Signals," by Mr. W. H. Davis. Demonstration with a Sterling Mine-signalling apparatus.

Royal Society of Arts.—Monday, February 15th. At 8 p.m. At John Street, Adelphi. Fothergill Lecture on "Motor Fuel," by Prof. V. B. Lewes.

Institution of Electrical Engineers (Newcastle Local Section).—Monday, February 15th. At 7.30 p.m. At Mining Institute. Discussion on "Wiring."

Institution of Post Office Electrical Engineers.—Monday, February 15th. At 6 p.m. At Institution of Electrical Engineers, Victoria Embankment, W.C. Paper on "Wireless Call Devices," by Mr. L. B. Turner. Demonstration following.

Illuminating Engineering Society.—Tuesday, February 16th. At 8 p.m. At House of Royal Society of Arts, John Street, Adelphi. Discussion on "The Development and Design of Lighting Fixtures in Relation to Architecture and Interior Decorations," opened by Mr. F. W. Thorpe.

Institute of Marine Engineers.—Tuesday, February 16th. At 8 p.m. At Tower Hill, Minories, E. Discussion on "Fuel Test."

Nottingham Society of Engineers.—Wednesday, February 17th. At 7.30 p.m. At Welbeck Hotel, Milton Street. Paper on "The Apprentice Question," by Prof. C. H. Bulleid.

Institution of Mechanical Engineers.—Friday, February 19th. At 8 p.m. At Storey's Gate, S.W. Annual General Meeting. Paper on "Convertible Combustion Engines," by Mr. A. E. L. Chorlton.

Royal Institution of Great Britain.—Friday, February 19th. At 9 p.m. At Albemarle Street, W. Paper on "The Visit of the British Association to Australia," by Prof. H. E. Armstrong, F.R.S.
Saturday, February 20th. At 3 p.m. Lecture on "Recent Researches on Atoms and Ions," by Prof. Sir J. J. Thomson, F.R.S.

Association of Mining Electrical Engineers.—Saturday, February 20th. At 4.30 p.m. At Royal Technical College, Glasgow. Paper on "Some Experiences in the Handling of Electricity," by Mr. A. Smellie.

NOTES.

The War and Foreign Trade.—THE JANUARY FIGURES.—The following are the electrical and machinery figures given in the official returns for January :—

	Month of January.		*Inc. or dec.*
IMPORTS.			
Electrical goods and apparatus, excluding machinery and uninsulated wire...	£56,865	−	£81,646
Machinery	£618,404	+	£19,013
EXPORTS.			
Electrical goods and apparatus, excluding machinery and uninsulated wire	£269,893	+	£16,172
Machinery	£1,663,482	−	£1,724,253

Electric Cars and Accessories at the New York Show.—The wider use of the battery for ignition, the practically universal adoption of electric starting and lighting, improvements in electric gear-shifting mechanisms and the introduction of electric transmission systems were features of electrical interest at the fifteenth annual national automobile show held in New York, January 2ad to 9th.

The development of electrical accessories for 1914, as evidenced by various devices shown, has been directed chiefly towards greater simplicity, and, wherever possible, a reduction in weight. This has been particularly the case with magnetos. Among the starting apparatus there were a variable-speed compound-wound machine of improved type and several new devices for starting Ford cars. With lighting systems the lamps have been made simpler in appearance. Many devices were also shown for dimming the brilliance of headlamps.—*Electrical World.*

Melbourne City Council and British Preference.—At a December sitting of the Melbourne City Council, consideration was given to a letter from the British Trade Commissioner, Mr. G. T. Milne, suggesting that the Council in all its purchases should give preference to goods manufactured either in the Commonwealth or in the United Kingdom, and to recommendations of the Electric Supply Committee, as follows :—

"In purchasing or obtaining any goods, machinery, or material, the Council will give effective and substantial preference to goods, machinery or material manufactured or produced in the Commonwealth. If goods, machinery or material manufactured or produced in the Commonwealth cannot be purchased, or can only be purchased in insufficient quantities, or of a quality unsuitable for the work, the Council will give substantial and effective preference to goods, machinery or material produced and manufactured in the United Kingdom, as against those of foreign manufacture."—*Australian Mining Standard.*

Inquiries.—Makers of the "Franco," "Standard," and other flash-lamp refills are asked for; we understand that our correspondent has orders to place for large quantities. Makers of a substitute for Galalith are inquired for.

Iron Leads for Installation Work.—The Prussian Minister of Commerce and the Minister for the Interior have issued a joint memorandum pointing out that under existing conditions difficulties should scarcely any longer be met with in securing connections with central stations owing to the lack of installation materials, seeing that the Union of Electrical Engineers, in agreement with the makers of installation materials, has extended its standards to the possibility of the employment of iron conductors with impregnated paper insulation and a watertight metallic outer envelope. It is further suggested that easy terms of payment should be introduced for facilitating the carrying out of installation work, and that lower charges for supply should be granted in connection with small installations for a certain period.

Low-Tension Auxiliary Supply in High-Tension D.C. Traction Systems.—One of the minor problems associated with high-tension direct-current traction systems is that of obtaining current at low pressure for train lighting and the supply of heaters, fans and other auxiliaries, by means of a pressure-reducing apparatus at once light, compact and reliable. On the Biasca-Acquarossa 1,200-volt electric railway, on the 1,500-1,800-volt Wendelstein system, and on the Tavannes-Noirmont line in Swiss Jura there have been used, during the last few years, pressure-reducing motor-generators supplied by Brown, Boveri & Co. Each set comprises a direct-coupled interpole motor and dynamo, with differential compound winding on the motor for voltage regulation. The special feature, by which high-tension current is confined to the motor armature, is excitation of the high-tension machine by low-tension current derived from the lighting dynamo. The motor interpoles are connected to the earthed side of the motor-armature. Shunt characteristics are secured in the motor, but only its armature need be insulated for high pressure; the insulation there used is a special mica composition tested to 9,000 volts A.C.

These sets have proved so satisfactory in service that they are now adopted as standard by the makers for all D.C. traction systems operating at 1,200 volts or higher pressures. To save space and weight, both motor and generator armatures are mounted on the same shaft within a cast-steel housing serving as magnetic yoke for both field systems. The pole cores are bolted on. Besides supplying the lighting circuits, the dynamo also supplies current for heating purposes and for fans, air pumps, and any other auxiliary services on the train. Six standard sets range from 2 to 40 KW. output, and are wound for 1,500 to 2,500 volts primary and 30 to 330 volts secondary pressure. The 40-KW., 1,090-R.P.M. set, wound for 2,000-2,200 volts primary pressure, weighs 3,410 lb. net, and is used in all coaches on the Chur-Arosa and Nyon-Morez lines. To eliminate reproduction in the secondary circuit (proportionately reduced) of variations in the line pressure, a Brown-Boveri automatic voltage regulator may be used to operate on the dynamo excitation; differential compounding of the motor is provided on all new locomotives of the Oberland-Bernois lines, the revolutions per minute of the reducing set (which is direct coupled to a ventilating fan), being constant between primary pressure limits 1,300-1,700 volts. Sudden closing of the line circuit does not produce excessive sparking on the H.T. motor commutator, and special attention has been directed to securing sparkless commutation during normal operation. A 40-KW. four-pole single commutator motor designed for 2,200 volts commutates sparklessly on 3,500 volts under 20 per cent. current overload.—*La Lumière Electrique.*

A New Turbo-Electric Steamer.—As previously reported in this journal, the large Swedish steamship company, the A/S Svealolaget, has lately been making an experiment by building a new turbo-electric steamer, which seems to be of considerable importance. The company has had under construction at the Lindholmen Shipbuilding Yard at Stockholm two steamers, which have been built according to the same drawings, and resemble each other as closely as possible. This has been done with the view of making a fair comparison between them possible. Both steamers have now been completed, and have a displacement of 2,225 tons; they have been designed for a normal speed of 11 knots. The first one, the *Mimer*, was finished in October, and was equipped with an ordinary triple-expansion engine, while the second, the *Mjölner*, was completed just before Christmas, when it underwent its first trial with its turbo-electric plant, which was designed by the Swedish engineer Ljungström. The turbine plant occupies much less space than ordinary triple-expansion engines, and is not so expensive as a Diesel engine. The consumption of coal was estimated to be less than for ordinary steamers, and, in fact, there was guaranteed a saving of 30 per cent. of coal. On the trial trip the *Mjölner* was fitted with the screws of the *Mimer*, and the trial, which lasted seven hours, gave excellent results. The machinery, in which gearing is employed, developed 975 I.H.P., or 75 H.P. more than it had been designed for, and an average speed of 11·8 knots was obtained. The consumption of coal turned out to be 35 per cent. below that of the sister-ship, and during the three hours, when the consumption was measured, the quantity of coal required per I.H.P.-hour amounted to 0·88 lb. Representatives of the shipping and technical world who accompanied the ship on its trial trip, among whom were also representatives of the Swedish Navy, expressed their satisfaction with the results obtained, and there was, in fact, unanimous agreement that the turbo-electric steamers would be the ships of the future.

Fatalities.—A Cape Town correspondent reports that an accident occurred at Sea Point, on January 11th, whereby a young man named Arthur Grover, an electrical jointer in the employ of the Cape Town Corporation, lost his life. It appears that Grover was occupied in cleating up some high-tension live wires in a new transformer station when he noticed some "arcing" in progress between one wire and the wall of the transformer station. Instead of switching off the high-tension side, which would have necessitated his walking to the next transformer station, he simply told his assistant (a coloured man) to take the wire out of his way. The assistant did so by placing the wire on the floor with a bare end exposed, and shortly afterwards Grover accidentally touched the bare end; as he was then standing in an open trench, he received practically a full 2,000-volt shock to earth. A local doctor was immediately in attendance, but on his arrival pronounced life to be extinct.

An inquest was held at Brotton-in-Cleveland, on February 2nd, touching the death of Hugh Fraser (39) who was fatally injured at the Skinningrove Ironworks on the previous Saturday morning, whilst in charge of an electric elevator at the gas producer.—William Wild, electrician, stated that deceased had full charge of the elevator. Hearing of the accident, witness went up the elevator into the machine house, and found Fraser on the machinery gear fastened by his clothing, which was badly torn. Witness at once secured the necessary tools to take the machinery to pieces. Deceased talked to the workmen while they were endeavouring to release him, and he told witness that in returning from an examination of the coal bunker on the elevator, he stepped on to the casing of an electric motor and slipped, falling into the moving machinery. Before going to examine the coal bunker, Fraser should have stopped the machinery, which he could have done in a second or two.—Replying to Mr. W. B. Lauder, H.M. Inspector, witness admitted that there was no controlling switch for the motor in the motor-house, and there was no fencing for the cog-wheels or shafting. Fraser had been in charge of the plant only a week, but thoroughly understood his work.—The jury returned a verdict of "Accidental death," and suggested that H.M Inspector should take steps for having the machinery better protected.

An inquest was held at Westminster on 2nd inst. into the death of Frederick Charles Humphries, aged 30, a gateman employed on the Piccadilly and Brompton Railway. Humphries was missing from his train (which was coming from Finsbury Park) when it arrived at the next station after leaving Leicester Square. His body was subsequently found about 13 yards inside Leicester Square tunnel. He died in hospital next morning. The medical evidence showed that deceased was severely burned by the live rail, and his feet were run over. One of the company's electrical engineers, in giving evidence, said that this particular train was the only one of the kind running. Probably the deceased had not securely closed the sliding door, which would have a tendency to open with the train in motion. A verdict of "Accidental death" was returned.

American Electrical Development.—We have before us an interesting 20-page pamphlet, entitled "What it Has Done," the "it" being the Society for Electrical Development, Incorporated, of New York. The Society is a strong and representative organisation, whose enterprising efforts to popularise electrical service of all kinds have been frequently reviewed in our columns. The objects of the present publication are:—To inform the Society's own members of what it has done (moving picture demonstrations, publication of articles in magazines and trade journals, advertising, and other forms of publicity, "field co-operation," research departments, display service bureau, and so forth); also to act as a campaign document in interesting the men engaged in the electrical industry who are not yet members of the Society. A "National Electric Week" is now being organised. Mr. J. M. Wakeman, is the general manager (29, West 39th Street, New York).

Institution and Lecture Notes.—Institution of Electrical Engineers.—ASSOCIATE MEMBERSHIP EXAMINATION.—An examination will be held on April 30th and May 1st, at the Examination Hall of the Royal College of Physicians and Surgeons, Queen's Square, Bloomsbury, W.C. Should a sufficient number of candidates make application, arrangements will be made for the examination to be held concurrently in local centres. Entry forms, which must be returned not later than March 1st, may be obtained, together with the examination regulations, on application to the secretary of the Institution.

At the meeting of the MANCHESTER LOCAL SECTION, on Tuesday last, a paper was read by Prof. E. W. Marchant, on "Conditions affecting the Variations in Strength of Wireless Signals," and was followed by a discussion.

A paper on "Distribution and Rise of Temperature in Field Coils," was read before the SCOTTISH LOCAL SECTION in Glasgow, on Tuesday last, by Prof. Magnus Maclean, the paper being a collaborative effort by Prof. Maclean, and Messrs. D. J. McKellar and R. S. Begg. Sir John Snell, the president of the Institution, was present, together with Mr. Rowell, the secretary, and both delivered addresses.

At the meeting of the BIRMINGHAM LOCAL SECTION on Wednesday last, a paper was read by Mr. N. Shuttleworth, M.Sc., on "Polyphase Commutator Machines and their Application." A discussion followed.

Iron and Steel Institute.—The annual meeting will be held at the Institution of Civil Engineers, London, on Thursday and Friday, May 13th and 14th. Thursday, May 13th, has been provisionally fixed for the annual dinner, and the autumn meeting is expected to be held in London during the week ending September 25th.

Association of Mining Electrical Engineers.—At a meeting of the East of Scotland Branch, at Cowdenbeath, a paper was read by Mr. Wm. Webster, of the Lochgelly Iron Co., on "The Utility of Surface Earthing on Armoured Systems." The author questioned the utility of elaborate surface earthing installations on completely armoured systems, and pointed out that there was no compulsion to install earth-plates underground, although it was recommended to do so should the circumstances require it. He had seen instances where much time and money had been expended on elaborate systems of surface earthing without much consideration being paid to underground conditions. The laying-out of an elaborate earthing system suggested the possibility of a large leakage current, and that, to his mind, constituted a danger even where the earthing was perfect. He was favourably disposed to the use of leakage trip gear for the prevention of dangerous leakage currents. Where these were installed, the insulation of the system would require to be kept in a higher state of efficiency, and the dangers from shock, fire, and ignition of gas or dust would be reduced to a minimum.

Rifle Shooting.—A match took place on February 4th, at Dalston, between the Electrical Press and Messrs. Siemens Bros. Dynamo Works, Ltd., the scores being:—Electrical Press, 738; Siemens Bros., 860 (10 a side). The visitors were hospitably entertained by the winning team, and the contest proved thoroughly enjoyable.

Patents and Alien Enemies.—Application has been made by Messrs. R. S. Wright and E. E. Burnside to the Board of Trade to avoid or suspend Letters Patent No. 25,101/12, granted to Bauer, for high-tension electrometers; the hearing is fixed for February 24th.

A licence has been granted to Mr. E. Mills in respect of Patent No. 362/12 (Hinselmann).

Educational Notes.—The Appointments Board of the UNIVERSITY OF LONDON recently issued a pamphlet setting forth the aims and work of the Board, which has for its main object the assistance of Graduates and Students of the University in securing appointments. It is stated that over 100 posts were so secured during the past year. Employers desirous of getting in touch with well-educated young men and women are invited to make use of the Register, and to make known their requirements to the Secretary of the Board at the University, South Kensington.

A foundation has been endowed by Lord Rosebery at the London School of Economics and Political Science, whereby two prizes, one of £25 and one of £10, will be awarded annually for the best monographs on a question dealing with the History, Theory, or Organisation of Inland Transport. For 1916 the subject is "Workmen's Trains." Candidates must be present or past students of the school.

Electrical Heating.—A Committee appointed by the Stockholm electricity and gas works, for the purpose of making exact inquiries into the subject of electrical heating with the view of ascertaining its cost compared with that of other heating systems, recently issued its report. The first step that was taken was to install hot-water apparatus in certain premises, together with thermostats, according to the system of Dr. Ekström. The water was heated by coke or by electricity. During the winter the premises were heated alternately by means of two systems for two weeks at a time, during which experiments the consumption, temperatures, &c., were kept under close observation.

The experiments were carried out in two different ways. In one case the apparatus were in partial operation during the whole day and night, and attendance was dispensed with, as the system worked automatically. In the other case, the supply of heat was cut off for the night from 5 p.m. until 7 a.m. With few exceptions the temperature in the morning was as high as 18° C. Between 9 a.m. and 5 p.m. the apparatus were working automatically.

When the systems were in use the whole day and night, it was found that the consumption of 1 hectolitre of coke corresponded to 198 KW.-hours of electricity. The efficiency of the hot-water system averaged about 60 per cent.

When the current was switched off for the night, 1 hectolitre of coke was equivalent to 120 KW.-hours, representing a saving of about 40 per cent.

As regards the capital expenditure, with consequent interest and depreciation, the Committee arrived at the result from the experiments that the cost was about the same for both systems, and it came to a similar conclusion with regard to the cost of up-keep. With reference to the attendance, the expenses for the electrical system were practically *nil*, while those of the other system amounted to about 20 per cent. of the cost of the fuel.

The results derived from the experiments show that when the price of coke is 1·50 kr. per hl. (1s. 8d.), as much as 0·76 öre per KW.-hour can be paid for continual heating, and 1·25 öre (1¼d.) with 10 hours' heating. If the cost of attendance be included, the above-mentioned figures will be raised respectively to 0·90 öre and 1·50 öre (1 krone = 100 öre = 1s. 1½d.)

The Committee comes to the conclusion that in consideration of the great advantages of the electrical system it ought to be possible to go even beyond those prices. Surplus electrical energy from water-power plants is regarded as the most suitable source of supply for electrical heating. Whether more satisfactory results could be obtained by dispensing with hot water pipes and using electric radiators in the rooms was not stated, but in view of the increased efficiency of this method the results would probably be more favourable.

Appointments Vacant.—Assistant engineer (£125) for Burgh of Hamilton Electricity Supply; electrical foreman, (£280 +) for Federated Malay States Government Railway; meter tester (35s) for Borough of Salford; junior assistant (£1) for Llanwrst Electric Light Works; chief inspector of railway telegraphs for Ceylon Government Railway (£250 +); junior shift engineer (30s.) for Luton Electricity Works; shift engineer (35s.) for Colne Corporation Electricity Works. Particulars are given in our advertisement pages.

Electricity in Surgery.—The medical correspondent of the *Times* in Calais states that the radiographic room of the Queen Elizabeth Hospital there, which is under Belgian control, and is used for wounded Belgian soldiers, possesses an exceptionally interesting and up-to-date electrical equipment. Apparatus is provided for taking instantaneous X-ray photographs, with the minimum of discomfort to the patient, and the localisation of foreign bodies is facilitated by the use of stereoscopic X-ray photographs. The water supply is sterilised with ultra-violet rays. The installation is in the charge of M. Emile Lejéot.

Workmen's Compensation.—The Finance and General Purposes Committee of the Bradford Corporation has decided that in view of the large percentage of the sums claimed under the Workmen's Compensation Insurance Fund for the three years ended March 31st, 1914, as compared with the premium income in the electricity department amongst others, the premium be increased from 12s. per cent. to 18s. per cent. for the years ending March 31st, 1915, and March 31st, 1916. The gas department rate has been increased from 12s. per cent. to 20s. per cent.

Special Services in London.—In the course of a paper read before the Telephone and Telegraph Society of London, by Mr. D. H. Kennedy (Assistant Superintendent Engineer, Post Office Engineering Department), on January 25th, interesting demonstrations were given of the working of some of the "special services" in operation in the metropolis. A test call was sent from the Lecture Hall of the Institution of Electrical Engineers to the fire brigade stations at Scotland Yard and Whitefriars; a horsed escape and a horsed fire engine from the former and a motor fire engine from the latter arrived simultaneously in 2 minutes and 20 seconds from the moment when the handle of the fire alarm was pulled, the officers entered the theatre and spoke to one of the stations at two minutes thirty-three seconds. An order was telephoned to Selfridge's, and the article required was delivered in nineteen minutes, in spite of the foggy weather; the distance traversed was 1 mile 1,500 yards, and at a preliminary trial earlier in the day the feat was accomplished within 15½ minutes.

The author gave particulars of the remarkably varied "special services" which are provided by the telephone and telegraph department, in connection with public business, public information, public safety, and public pleasure. It appears that as there are no fewer than 12,000 private branch exchanges in the London area, and only 2,500 working positions at the main exchanges, the number of private exchange operators far exceeds the number of main exchange operators; 29 private exchanges have 112 operators' positions and nearly 7,000 stations. The Stock Exchange and the adjoining buildings constitute the most densely-telephoned area in the kingdom, possessing an extraordinary number of telephone cabinets. The news services transmit on an average more than 2,000,000 words a day. It is not generally known that the department has for many years maintained the system of division bells at the Houses of Parliament; moreover, a number of Members who live within six minutes by motor-car have had installed in their houses bells connected with the system, so that they can stay at home until their presence is indispensable. Various special services have been necessitated by the war, including one for the Press Bureau, which was installed in two days; 22 cabinets are provided for the use of Press representatives, who act in accordance with strict rules. When a news item has been passed by the Censor, it is distributed to all the reporters, who on a given signal simultaneously rush to their respective cabinets and call up their offices. The Department also maintains a complete system of fire alarms for the London Fire Brigade, and a similar system of street pillar boxes for the City Police Ambulance service; the average time from the occurrence of an accident to the arrival of the ambulance is under four minutes. A larger ambulance system is also maintained for the Port of London Authority.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—Mr. Fred. Tyrrell, assistant engineer at Ascot electrical works, has been appointed to a similar position under the Nigerian Government at Lagos.

Mr. F. Crooks, clerk and collector to the Bridlington Corporation electricity department, applied for leave of absence in order to enlist in H.M. Forces, but the Electricity Committee is unable to consent, his services being essential to the department at the present time.

Mr. H. N. Newcombe has resigned his position as engineer-in-charge at the borough of Wimbledon electricity works. Mr. H. Oswald has been appointed temporary engineer-in-charge, at £104 per annum.

Mr. J. Ellis has resigned his position as shift engineer at the Watford electricity works.

Mr. F. J. Stratford, of Newton Abbot, has been appointed shift engineer at the Corporation electricity works at Bexhill-on-Sea.

General.—There were some 400 signatories, representing commercial interests in Dublin, Belfast, Cork, Limerick and other Irish centres, to an address presented to Mr. Wm. M. Murphy, chairman of the Dublin Tramways Co., in the Dublin Chamber of Commerce, in recognition of his valuable work as President of the Chamber and in relation to the tramway and other strikes of the year 1913. Accompanying the address were two fine portraits of Mr. Murphy, by Mr. Wm. Orpen, the distinguished Academician, one of which is to be hung in the Council Room of the Chamber. In his reply Mr. Murphy claimed that his enterprises had been free from self-seeking, and that what success had attended them was due mainly to those associated with him. He had, he said, carried the Irish flag far afield in commercial undertakings, and had proved that an Irishman, making his headquarters and spending his life in his native land, was not handicapped to such an extent as to prevent him from successfully extending his interests to Great Britain and abroad.

The *Times*, in announcing the staffs of the special departments at the King George Hospital, says that the following three physicians have undertaken to advise as to the equipment of the X-ray department, and, in conjunction with the visiting staff, to render themselves responsible for its work:—W. Ironside Bruce, M.D., physician, X-ray department, Charing Cross Hospital; Stanley Melville, M.D., physician, X-ray department, Brompton Hospital; G. Harrison Orton, M.D., physician, X-ray department, St Mary's Hospital. The Joint Committee are advised that the expense of the establishment of this department will amount to £750.

Mr. F. Large, of Great Barrow, has been presented by his colleagues at the Helsby Works of the British Insulated and Helsby Cables, Ltd., with a case of cutlery.

Mr. W. Mottershead, works foreman at the Corporation electricity works at Tunbridge Wells, has received an appointment under the Admiralty.

The marriage took place at St. George's Church, Hanover Square, London, W., on February 2nd, of Mr. Walter T. Smith, of Messrs. T. Smith & Sons, electric crane manufacturers, of Rodley, near Leeds, and Miss Beatrice May Haysom, daughter of Mr. Geo. Haysom, L.C.C., of Hayling, South Croydon.

Aldeeman Tyrrell has been re-elected chairman of the Belfast Corporation Tramway and Electricity Committee, and Councillor Duff has been appointed vice-chairman.

The North-East Coast Institution of Engineers and Shipbuilders has conferred upon Lord Fisher the honorary membership of the Institute, in recognition of his support of the reform recently embodied in the Admiralty order conferring military rank upon the engineer officers of the Royal Navy.

Mr. Chas. Lill, who resigned his appointment with the Hackney Borough Council a short time ago in order to join Messrs. J. and H. Grevener, has, owing to the national crisis and with regret, severed his connection with that firm and has since been appointed engineer and manager to the Albion Electrical Co., Ltd., of 67, New Oxford Street, W.C.

Obituary.—Mr. Wm. Bulloch.—We regret to learn that the death took place, on Tuesday, at his residence, Normanhurst, Newbridge, Wolverhampton, of Mr. William Bulloch, a director of the Electric Construction Co., Ltd., Bushbury, and for over 20 years manager of the company's works. The deceased gentleman attended to his business engagements so recently as Friday in last week, and it was only on Saturday he was seized with the illness which, unfortunately, proved fatal. Mr. Bulloch, who was a Scotsman, was only 44 years of age. During the period of his management the E.C.C. works have extended and developed, and many departments have been reorganised. He took the keenest interest in the workmen, and was closely identified with their institute and their organised sports and recreations. For many years he was a member of the Wolverhampton Chamber of Commerce. For two years—1907 and 1908—he occupied the presidential chair, and he served on several committees, being present at one of the meetings last Wednesday week. Mr. Bulloch was also a vice-president of the Wolverhampton and District Engineering Society. He will be missed in many circles, but especially at Bushbury; and sympathy will be unreservedly extended to Mrs. Bulloch and the family of five boys and one girl who mourn his decease.

Mr. J. H. Waddon, J.P.—The death has taken place of Mr. John Henry Waddon, J.P., a former Mayor of Bridgwater, and one of the pioneers of the local electric light undertaking.

Mr. A. J. Ickringill.—The death took place, on February 2nd, at Guelph, Ontario, after an operation for appendicitis, of Mr. Arthur Jas. Ickringill, a director of the Keighley (Yorks.) Electrical Engineering Co., Ltd. He was only 39 years of age.

Mr. Arthur Keen.—The death occurred on February 8th at Birmingham, at the age of 80 years, of Mr. Arthur Keen, of Guest, Keen & Nettlefolds and other important engineering undertakings.

NEW COMPANIES REGISTERED.

Spicer & Co., Ltd. (139,205).—This company was registered on February 2nd, with a capital of £500 in £1 shares, to take over the business of electrical engineers carried on by Charles Gustav Louis Heim and Edward Norcock Harwood Spicer, at 1, Cottage Lane, City Road, E.C., as "Spicer & Co." The subscribers (with one share each) are: E. N. H. Spicer, 1, Cottage Lane, City Road, E.C., manufacturer; C. G. L. Heim, 1, Cottage Lane, City Road, E.C., merchant. Private company. The number of directors is not to be less than two or more than five; the first are not named. Solicitors: Bate & Co., 35, Bedford Row, W.C.

Standard Insulator Co., Ltd. (139,241).—This company was registered on February 4th, with a capital of £100 in £1 shares, to carry on the business of manufacturers and proprietors of and dealers in magnetos, magneto parts and accessories, motors, motor and other carriages, vans, wagons, motors, launches and flying machines, electricians, engineers, rubber manufacturers, etc. The subscribers (with one share each) are: H. Doe, 14, Regent Street, S.W., clerk; R. Budgen, 96, Mildenhall Road, Clapton, N.E., clerk. Private company. Table "A" mainly applies. Solicitors: J. B. & F. Purchase, 14, Regent Street, S.W.

E. S. Co., Ltd. (139,230).—This company was registered on February 4th, with a capital of £2,000 in £1 shares, to take over from E. C. Beman the business of an electrical supply agent and wholesale factor carried on at 53, Victoria Street, Westminster, as the Electrical Supplies Co. The subscribers (with one share each) are: E. C. Beman, 53, Victoria Street, Westminster, S.W., electrical engineer; F. J. Roden, 53, Victoria Street, Westminster, S.W., traveller. Private company. The number of directors is not to be less than two or more than five; the first are E. C. Beman and F. J. Roden (both permanent, with £260 and £208 per annum respectively as remuneration). Qualification £100. Registered office: 53, Victoria Street, Westminster.

Arthur Lyon & Wrench, Ltd. (139,224).—This company was registered on February 4th, with a capital of £12,000 in £1 shares, to take over as going concerns the businesses carried on at 5, Crawford Passage, Farringdon Road, E.C., and elsewhere, as the "Wrench Manufacturing Co.," and at Caxton House, Westminster, as "Arthur Lyon & Co.," to carry on the business of manufacturers of cinema requisites, and electro-mechanical engineers, manufacturers of lamps, light-projecting apparatus, dynamos, signalling apparatus, searchlights, arc projectors, oxy-hydrogen and oxy-petrol lighting sets for motor cars, motor lorries, motor locomotives, aeroplanes, monoplanes, hydroplanes, biplanes, etc., and to adopt agreements (1) with H. H. Wrench, and (2) with A. A. Lyon and Goldenlyte, Ltd. The subscribers (with one share each) are: H. H. Wrench, Kensington Palace Mansions, W., manufacturer; A. A. Lyon, Caxton House, Westminster, engineer. Private company. The number of directors is not to be less than three or more than seven; the first are H. H. Wrench, A. A. Lyon, W. Engelke, and A. F. Burman (all permanent). Qualification, 500 ordinary shares. Remuneration as fixed by the company. Registered office: Caxton House, Westmisnter.

Kaywright Engineering Co., Ltd. (139,257).—This company was registered on February 6th, with a capital of £500 in £1 shares, to carry on the business of electrical and mechanical engineers, builders, contractors, electricians, producers and suppliers of electricity, etc. The subscribers (with one share each) are: R. Orwin, 42, Elvedon Road, Palmers Green, N., engineer; F. R. Orwin, 42, Elvedon Green, N., pattern maker. Private company. Table "A" mainly applies. Solicitors: Davidson & Morriss, 40-42, Queen Victoria Street, E.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

St. Helens Cable & Rubber Co., Ltd. (87,774).—Capital, £10,000 in £1 shares. Return dated Dec. 31st, 1914. All shares taken up; £10,000 paid. Mortgages and charges, £148,464.

Perfect Burglar Alarm Co., Ltd. (recently known as Lichtenfeld Burglar Alarm Co., Ltd), (112,522).—Capital, £4,000 in £1 shares (1,000 pref.). Return dated Dec. 18th, 1914. 230 pref. and 1,710 ord. shares taken up; £1 per share called up on 1,210 shares and 5s. per share on 230 shares; £1,267 10s. paid; £500 considered as paid on 500 shares. Mortgages and charges, nil. Name changed on Jan. 13th, 1915.

Provincial Tramways Co., Ltd. (6,445).—Capital, £275,440, in 10,000 pref. shares of £10 each and 175,440 ord. shares of £1 each. Return dated Dec. 10th, 1914. 10,000 pref. and 124,560 ord. shares taken up; £10 per share called up on 3,814 pref. and £1 per share on 124,560 ord. shares; £162,700 paid; £61,860 considered as paid on 6,186 pref. shares. Mortgages and charges, £175,000.

Gosport & Alverstoke Electric Lighting Co., Ltd. (82,693).—Capital, £5,000 in £10 shares. Return dated Dec. 11th, 1914. All shares taken up; £5,000 paid. Mortgages and charges, nil.

Ferranti, Ltd. (83,718).—Capital, £130,000 in £1 shares (160,000 pref., 60,000 ord., and 10,000 defd.). Return dated Nov. 13th, 1914. 60,000 pref., 53,374 ord., and 10,000 defd. shares taken up; £123,374 considered as paid. Mortgages and charges, £157,962 11s.

CITY NOTES.

Yorkshire Electric Power Co.

THE directors report that for the year ending December 31st, 1914, the net profit on the revenue account, after payment of mortgage interest for the three years ending December 31st, is as follows:—1912, £7,361; 1913, £15,401; 1914, £20,535, plus £4,188 brought forward, making £24,723. Deducting the dividend paid to June 30th, 1914, on the preference shares, £4,392, and on the ordinary shares £2,552, there remains a disposable balance of £17,778, which is to be dealt with thus:—Dividend for the half-year ending December 31st, 1914, at the rate on the preference shares (6 per cent.), £4,979; write off the bonus paid upon the second mortgages, £2,250; transfer to general reserve fund, £7,500; carry forward £3,049. In view of the progress of the company during the first six months of 1914, the directors felt justified in July in paying a dividend at the rate of 2 per cent. per annum, a rate which they had reason to believe would be maintained for the whole year. Immediately following this the outbreak of war caused a serious reduction in the current used by customers during the months of August and September, and checked the expanding revenues of the company. For the last three months of the year the revenue has again shown considerable improvement, being a substantial increase on that of the corresponding months of 1913. Owing to the financial caution, which is specially advisable at present, the directors recommend the shareholders to be satisfied with the dividend already paid (equal to 1 per cent. for the whole year), so as to strengthen the position of the company, by placing £7,500 to reserve, raising this fund to £12,500.

On February 17th of last year the proprietors authorised the issue of a further 10,000 6 per cent. preference shares of £5 each, making a total authorised issue of £300,000. Applications were made by holders of second mortgages for £35,405, making, with further applications which have since been received for these and the balance of the former issue, a total of £56,365 taken up during 1914. Applications are being received for the balance, which at this date is £13,090.

The second mortgages, which, with the bonus upon them, amounted to £17,250, have been repaid. In order to give further security to the company's bankers, the mortgages have been transferred to them instead of being allowed to lapse.

To provide the capital required for the additional plant and machinery installed at Barugh power station, the Yorkshire Waste Heat Co., Ltd. (of which the power company is the sole shareholder) sanctioned an issue during 1914 of a further £22,000 of 5½ per cent. first mortgage debenture stock of that undertaking.

Out of the rent paid for the use of the Barugh station a sinking fund is set aside by the Waste Heat Co. to repay their debenture stock on December 31st, 1937. The sum accumulated to December 31st, 1914, amounts to £1,391.

Electrical Distribution of Yorkshire, Ltd., now hold 16 Electric Lighting Provisional Orders, for which a bulk supply of energy is taken from the power company. In order to extend their operations, an allotment of £12,500 of ordinary capital was made to their shareholders during the year. The business of that company has throughout shown steady and advancing progress, and the directors decided to increase the holding of the Power Company by taking up further capital.

The meeting will be held at Leeds on Tuesday, February 16th.

St. James' and Pall Mall Electric Light Co., Ltd.

THE directors report that the connections, which at the end of 1913 were 15,119 KW., have been increased to 15,423 KW. and 11,171,348 units were supplied to consumers. The Central Electric Supply Co., Ltd., has declared a dividend of 5 per cent. on the ordinary shares and £2,500 (less tax) will be payable to this company. The revenue derived from the sale of electricity has been greatly reduced by the war. The company is associated with other London electric supply undertakings in the promotion of a Bill entitled the London Electric Supply (No. 2) Bill. The net profits for the year 1914, applicable to dividends on shares, amount to £27,133 plus £2,283 brought forward. Deducting the interim dividends paid in August last at the rate of 7 per cent. on preference shares, £3,500, and 10 per cent. on ordinary shares, £10,000, £15,917 remains to be dealt with. After paying the further 7 per cent. preference dividend, a dividend on the ordinary shares for the second half-year of 5s. per share is recommended, making, with the interim dividend paid in August last, a total distribution of 10 per cent. for the year, £10,000, leaving £2,417 to be carried forward.

Generated and purchased—		Private supply	11,171,348
Generated by steam plant	1,403,027	Works	310,338
Purchased	13,250,939	Batteries	336,070
		Transmission and transformation	2,136,918
		Distribution and unaccounted for	699,347
Total	14,654,016	Total	14,654,016
Total connections	15,423 KW.		

Annual meeting, February 16th.

Lanarkshire Tramways Co.

FOR the half-year ended December 31st, 1914, the revenue was £48,583, and the expenses were £31,544, leaving £17,039. After meeting debenture and other interest charges and contributions to local authorities there remains £13,873, plus £5,645 brought forward. £9,000 has been placed to reserve for depreciation. £9,432 is absorbed by dividend at the rate of 5½ per cent. per annum for the half-year on the share capital, £167 is paid to directors, and £919 is carried to revenue new account. The revenue shows an increase of £192, and the expenses an increase of £5,088, as compared with the revenue and expenses for the corresponding half-year of 1913. For the month of July the traffic receipts were over £1,000 in excess of the figures for the corresponding month of 1913, but from the outbreak of the war there was a continuous falling off in the receipts, and it is estimated that there was a decrease in the revenue of fully £4,000 on this account. The increase in expenses was mainly due to operating the lines leased from the Lanark County Council, which were not in operation for the full half-year of 1913, and to heavier maintenance charges for permanent way, rolling stock, &c. A large number of employés have joined the Colours, and allowances to wives and dependents to December 31st cost £329. Payments to local authorities for the year will amount to £1,730, of which £1,433 was reserved in the accounts to June 30th, leaving a charge in the past half-year's accounts of £297. A dividend for the half-year at the rate of 5½ per cent. per annum is recommended, making 5¾ per cent. for the year.

Half-year ended—	Miles open.	Passengers carried.	Traffic receipts.	Average fare.	Car-mileage.	No. of cars.
June, 1913 ..	24·62	8,579,876	£42,884	1·20d.	979,621	66
December, 1913 ..	34·29	9,471,832	£47,760	1·21d.	1,074,440	78
June, 1914 ..	36·47	9,926,810	£49,923	1·21d.	1,169,837	78
December, 1914 ..	36·47	9,467,472	£48,035	1·22d.	1,161,066	78

Dublin United Tramways Co., Ltd.

At the annual meeting, held on 3rd inst. in Dublin, the chairman Mr. W. M. Murphy, said the expenditure on capital account had exceeded the receipts by £68,836, but against this the company held £39,400 in redeemed bonds. Workshops at Ballsbridge had been extended, and £1,871 worth of additional machinery had been erected at Blackrock sub-station. On revenue account there were gross receipts of £3,066 in excess of 1912, and £24,166 in excess of 1913—the great strike year. This showed that their business had not been seriously affected by the war. Traffic, in fact, showed great vitality, as for last month (January) there was an increase of £2,109 over January, 1914, and £960 over January, 1912. Receipts from goods traffic had grown to £1,550—doubling since 1912—and parcels traffic reached £7,129. The working and general expenses, however, had increased by £14 378. A sum of £14,427 had been contributed to local authorities in respect of wayleaves for the year. The company now paid rates on a £41,000 valuation—an increase from £30,000 in two years. Operation cost £567 more than in 1912, and expenditure under maintenance showed, apart from rail renewal, a net increase of £4,749. Increases for renewal and maintenance of track, plant and rolling stock, must be looked forward to, but Mr. Murphy anticipated increased receipts to meet increasing expenses, maintaining net earnings. The balance for appropriation was £98,047, and after deducting preference and interim dividends, they were paying a final dividend of 5 per cent. per annum on the ordinary shares, leaving a surplus on profit and loss account of £34,366, the most urgent claim on the disposal of which was for renewal of portion of the track. They were, the chairman added, substituting a rail of 105 lb. to the yard for one of 92 lb. originally laid down. They had adopted the Thermit system of welding. A reserve of £40,768 had been depleted by £18 277 in respect of track renewal, and £18,000 would be given from the surplus to restore that fund, while £5,000 would go to general reserve, which would then amount to £55,679, and £11,366 would be carried forward, being £1,409 more than they carried forward from last account.

National Gas Engine Co., Ltd.—The directors report that the net profit for the year ended December, 1914, after providing amply for depreciation of buildings, tools, &c., and allowing for management salaries and income-tax, is £62,257. Interim dividends for the six months to June 30th, amounting to £28,500, being at the rate of 5 per cent. per annum on the preference shares, and 7½ per cent. per annum on the ordinary shares, were paid on July 31st, 1914, leaving a balance of £33,757, which, added to £11,903 brought forward, makes a total of £45,660 to be dealt with. The directors recommend the payment of a final dividend at the rate of 5 per cent. per annum on the preference shares and one of 7½ per cent. per annum on the ordinary shares, both less income-tax, for the six months ended December 31st, 1914. This will absorb £28,500, and leave £17,160, which it is proposed to carry forward.

Companies Struck off the Register.—The following companies have been struck off the Register, and are accordingly dissolved :—

Automatic Lock Nut Co.
British Medical Electric Appliances Co.
Dioptric Sign Co.
Electrical Power Users' Association.
Electric Fire Prevention Appliances and General Mfg. Co.
Institution of Signal Engineers (Inc.).
International Marine Signal and Carbide Co.
International Syndicate for Electric Water-Power and Public Works Concessions.
London Electric Treatment Institute.
Machinery.
Mica Mines.
Never-Skid Band Manufacturing Co.
North Lancashire Tramways Power and Construction Syndicate.
Power Engineers.
Star Electric Light Co.

Official Notices re Companies.—The following companies will be struck off the register at the expiration of three months unless cause is shown to the contrary :—

Alkaline Accumulators Paul Gouin.
Anglo-Brazilian Power and Shipping Corporation.
Beam Co. (British Electrical and Mechanical Co.)
Blast Furnace Power Syndicate.
Controllers (London).
County Electric Traction Co.
Electric Batteries and Carbons.
Leeds Electric Co.
Mego-Acoustics.
Schoenfeld Universal Oil Filter Co.
Silent Gear Syndicate.
Southwold Electricity Works.
Witney Electric Supply Co.

Smithfield Markets Electric Supply Co., Ltd.—The directors report that the gross profit for the year 1914 amounts to £4,576, compared with £5,764 and the net profit to £3,139, compared with £4,237 last year. A further sum of £400 has been placed to the debenture stock redemption fund (making a total of £793) and £1,000 to depreciation account. The available balance, including £791 brought in, is £2,530. A dividend at the rate of 2 per cent. per annum, on the ordinary shares will absorb £1,200, leaving £1,330 to carry forward.

Underground Electric Railways Co. of London, Ltd.—Subject to final audit, the revenue of the Underground Co. will enable it to pay full interest to December 31st, 1914, on its 6 per cent. first cumulative income debenture stock and on its 6 per cent. income bonds, and to carry forward about £35,000.

Central Electric Supply Co., Ltd.—The directors' report for 1914 states that energy has been supplied to the Westminster, St. James' and Pall Mall, and the Chelsea Companies to an amount of 28 967,111 units. After making a full allowance for sinking fund and depreciation the net balance for the year 1914 is £4,999. After paying of a dividend at the rate of 5 per cent. on the ordinary shares for the year £5,000, £6 remains to carry forward. The Right Hon. Wm. Hayes Fisher has been appointed a director.

Stock Exchange Notices.—Application has been made to the Committee to appoint a special settling day in and to grant a quotation to—

General Electric Co., Ltd.—Further issue of 10,000 ordinary shares of £10 each, fully-paid: and 30,000 6 per cent. cum. pref. shares of £10 each, fully-paid.

And to allow the following securities to be quoted in the Official List :—

Crompton & Co., Ltd.—79,539 ordinary shares of £1 each, fully-paid, Nos. 1 to 79,539; and 186,000 pref. shares of £1 each, fully-paid, Nos. 1 to 186,000 (renewed application).
General Electric Co., Ltd.—40,000 ordinary shares of £10 each, fully-paid.

Central London Railway Co.—The directors recommend the following dividends :—

On the undivided ordinary stock for the six months ended December 31st, 1914 at the rate of 2½ per cent. per annum, making with the interim dividend of £3 per cent. per annum, a dividend for the year 1914 of 2⅝ per cent.
On the preferred ordinary stock for the six months ended December 31st, 1914, at the rate of £4 per cent. per annum, making with the interim dividend, a dividend for the year 1914 of £4 per cent.
On the deferred ordinary stock for the year ended December 31st, 1914, a dividend of 1½ per cent., carrying forward £15,413.

City and South London Railway Co.—The directors recommend a dividend on the 5 per cent. preference stocks 1891 and 1896 for the six months ended December 31st, 1914, at the rate of 5 per cent. per annum, making with the interim dividend a dividend for the year 1914 of 5 per cent. No dividend will be paid on the 5 per cent. preference stocks 1901 and 1903 for the half-year ended December 31st, 1914.

City of Buenos Ayres Tramways Co. (1904), Ltd.—The report for the year ended December 31st, 1914, states that the annuity payable by the Anglo-Argentine Tramways Co., Ltd., has been received, and the net revenue for the year has amounted to £67,392. Interim dividends paid for the nine months ending September 30th, 1914, absorbed £46 500, leaving £20,892. The directors recommend a final dividend of 1s. 3d. per share (making 5s. per share—5 per cent. per annum—less income-tax) for the year, absorbing £15,500, and £5,200 is to be transferred to general amortisation fund, leaving £192 to be carried forward. Annual meeting, February 15th.

Tyneside Tramways and Tramroads Co., Ltd.—The accounts for the past half-year show a divisible balance of £6,241. Traffic receipts showing an increase of £2,263 compared with 1913. A dividend at the rate of 3 per cent. is proposed on the ordinary shares; £1,400 is to be placed to reserve and renewals fund, and £1,500 to special reserve, carrying forward £731.

London Electric Supply Corporation, Ltd.—The company has issued the following statement :—

	1914.	1913.
Profit	£93,234	£71,753
Dividend on ordinary shares	4 %	3 %
Sinking fund	£12,000	£12,000
Reserve account	10,000	*Nil.*
Contingencies account ...	7,000	3,000
Carry forward	8,828	5,098

Metropolitan District Railway Co.—The directors recommend the payments of dividends in full on the 4 per cent. guaranteed stock, and on the 4½ per cent. preference stock; and on the 5 per cent. second preference stock for the past six months at the rate of 1 per cent. per annum, making for the year 2 per cent.

London Electric Railway Co.—The directors recommend a dividend on the ordinary shares for the past six months at the rate of ¼ per cent. per annum, making for the year ⅝ per cent.

Parsons Marine Steam Turbine Co., Ltd.—The directors announce an interim dividend of 12 per cent.

STOCKS AND SHARES.

Tuesday Evening.

From the general Stock Exchange point of view, the most interesting points of the moment are those concerned with the Home Railway dividends. People were completely in the dark as to what the companies were likely to pay, the only guide being an assurance by the Government that traffics would be made up to a certain amount. This, of course, did not pledge the directors to maintain previous dividends. In two or three cases the announcements are satisfactory, but in the majority, the results are regarded as somewhat disappointing.

With reference to those with which this page is immediately concerned, the various distributions declared by the Tube Railways cannot be held as good. In one case—that of the Underground Electric Railways of London—the company has fulfilled hopeful anticipations by announcing the payment of the full dividend on the 6 per cent. income bonds, whereas some few weeks ago the idea was current that this rate might be cut down to 4½ or 5 per cent.

On the other hand, the Central London and the City and South London publish poor performances; and none too much satisfaction is felt with that of the London Electric Railways. Prices have mostly given way, and the Underground stocks have joined with the rest of the Home Railway group in showing decided signs of heaviness. The public decline to buy Home Railway ordinary and deferred stocks—at least, so the level of present prices indicates—unless the investments yield about 6 per cent. on the money; and inasmuch as this return can be obtained from several of the best-class ordinary shares in the steam-list, it is not surprising that others should give way.

	Mean price. July 27.	Feb. 9, 1915.	Rise or fall this week.
Home Electricity Companies.			
Brompton Ordinary	9⅜	8⅞	—
do. 7 per cent. Pref.	8⅝	8⅝	—
Charing Cross Ordinary	5⅛	4⅞	—
do. do. do. 4½ Pref.	4¼	4¼	—
do. do. City Pref.	4⅜	4	—
do. 4 Deb.	91½	90	—
Chelsea	4⅞	4¾	—
do. 4½ Deb.	96⅜	93	—
City of London	16	14⅛	—
do. do. 6 per cent. Pref.	13⅝	12¾	—
do. do. 5 Deb.	116⅜	114	—
do. do. 4½ Deb.	100¼	98	—
County of London	12	11⅛	—
do. do. 6 per cent. Pref.	12	11¼	—
do. do. 1st Deb.	102½	99	—
do. do. 2nd Deb.	100⅛	97	—
Kensington Ordinary	7⅜	7½	— ⅛
London Electric	1⅛	1¼	—
do. do. 6 per cent. Pref.	5⅛	5	—
do. do. 4 Deb.	92⅛	87	—2
Metropolitan	5⅝	5⅜	—
do. 4½ per cent. Pref.	4⅞	4	—
do. 4½ Deb.	97½	96	—
do. 3½ Deb.	83	78	—2
St. James' and Pall Mall	9⅜	9	—
do. do. do. 7 per cent. Pref.	7	6½	—
do. do. do. 3½ Deb.	81½	82	—
South London	3⅛	3	—
South Metropolitan Pref.	1½	1⅛	—
Westminster Ordinary	8⅝	8¼	—
do. 4½ Pref.	5⅜	4⅝	— ⅛
Home Rails.			
Central London, Ord. Assented	83	77	—1
Metropolitan	37½	30½	—1⅛
do. District	21⅜	17⅜	— ⅛
Underground Electric Ordinary	2¼	1⅞	— ⅛
do. "A"	7/6	6/-	—
do. Income	88	82½	— ½
Telegraphs and Telephones.			
Anglo-Am. Tel. Pf.	108½	106½	—
do. Def.	28	29	+ ⅛
Chile Telephone	7⅜	7⅛	—
Constantinople Tel.	4½	3½	—
Cuba Sub. Ord.	8½	8½	—
do. Pf.	16½	15½	—
Eastern Extension	12⅜	12½	+ ½
do. 4 Deb.	97½	94	—
Eastern Tel. Ord.	130⅝	128	+1
do. 3½ Pf.	77⅛	71	—
do. 4 Deb.	96⅛	94	+1
Globe Tel. and T. Ord.	11½	10¼	+ ½
do. Pf.	12½	11½	—
Gt. Northern Tel.	32½	27	—1
Indo-European	59	55	—
Marconi	1⅛	1⅛	+ 1/16
New York Tel. 4½	101	97	—
Oriental Telephone Ord.	2⅝	2	—
do. Pf.	1 3/16	1 3/16	+ ⅛
Tel. Egypt Deb.	98	82½	—
United R. Plate Tel.	6⅜	6	—
do. Pf.	5½	5	—
West India and Pan.	1⅞	1½	+ ⅛
Western Telegraph	15⅜	13	—
do. 4 Deb.	96½	95½	—
Foreign Trams, &c.			
Anglo-Arg. Trams, First Pf.	4⅞	4½	—
do. 2nd Pf.	4½	4	—
do. 4 Deb.	91	84	—1
do. 4½ Deb.	98½	93	—1
do. 5 Deb.	96	88	—
Brazil Tractions	66	54½	—2
Bombay Electric Pf.	11⅜	10½	—
do. 4½ Deb.	96	91	—
Mexico Trams.	70	40	—
do. 5 per cent. Bonds	84	60	—
do. 6 per cent. Bonds	76	50	—
Adelaide Sup. 6 per cent. Pf.	5½	5⅛	—
do. 5 Deb.	104	101½	+ ½
Manufacturing Companies.			
British Westinghouse Pref.	13⅞	17/16	— 1/16
do. 4 Deb.	74½	70	—
do. 6 p. lien	102½	98½	—
Callenders	11⅜	11⅛	—
do. 5 Pref.	5⅜	4⅝	—
do. 4½ Deb.	98⅜	98	—
Castner-Kellner	2⅜	8½	—
Edison & Swan, £8 pd.	11/9	11/6	—
do. do. fully paid	1½	2	—
do. do. 4 Deb.	59	60	—
do. do. 2 Deb.	63⅛	60	—
Electric Construction	1½	1/-	+ 6d.
do. do. Pf.	1⅛	1	—
Gen. Elec. Pf.	10½	10	—
Henleys	15	13½	—
do. 4½ Pref.	5	5	—
do. 4½ Deb.	100½	97	—
India-Rubber	9	8½	—
Telegraph Con.	38½	36½	—

Oddly enough, however, the preference stocks of the Home Railway companies are in good demand; and the discount of 2 points on Metropolitan 5 per cent. preference has given place to a small premium, while the new London and South Western preference, issued at 99¼ to pay for electrification work, has risen to 106¼. It will be seen from the subjoined price lists how the ordinary stocks have given way:—

Electricity supply shares lean a little to the dullish side. Westminster preference, for instance, have lost the small fraction they picked up last week. Kensingtons are 5s. down. The report of the St. James' Company is considered satisfactory enough in the circumstances. But a certain amount of anxiety is expressed as to the position of all the electric lighting companies, in regard to their holding of coal, and to the prices at which they will have to enter into new contracts.

The Borough of Wimbledon circularised its inhabitants with the intimation that, owing to the scarcity of coal, it might be necessary to curtail the supply of electric current. Inland Revenue offices in the City display small handbills urging economy in the use of electric light. One, at least, of the gas companies has issued a very strongly-worded appeal to its stockholders and consumers, begging them to use what influence they can to bring the matter before Parliament. All things considered, these are not good days for illumination industries.

The Bournemouth and Poole Company is offering its shareholders 2,500 6 per cent. second preference shares of £10 each at par, and, considering the excellence of the security, there can be little doubt about the success of the issue, which is one of the first, by the way, to receive the Treasury imprimatur of permission to appear. There is no premium on the shares in the market, but as a 6 per cent. investment of their class they will rank high. The Melbourne Electric Supply issue achieved distinct success, and the shares are already 7s. 6d. premium in the market, the old stock keeping about 170. Manufacturing shares are quiet. Electric Constructions continued to harden, and British Westinghouse preference wavered a trifle.

The foreign tramway list shows Brazil Tractions down a further 2 points, which leaves the price 54½. Mexican issues are also weak. Illustration of the state of the market may be seen in the fact that for one of the Mexican bonds, which was quoted nominally at 50, an insistent seller the other day obtained no more than 25. The condition of the unfortunate country at present holds out no hopes of improvement. Adelaide Supply debenture stock has hardened, on the absorption of a fair block which was offered at 101 free of stamp duty. The Anglo-Argentine debenture stocks have given way a point or so.

Telegraph stocks and shares are firm, and the advancing tendency recently shown is fully maintained. Rises have occurred this week in Anglo "B," "China" shares, Eastern ordinary, Globe ordinary and Panamas; and the only fall worth noticing is £1 in Great Northerns. Marconis hardened a shade on buying, said to be inspired by Irish sources. Americans are steady at 10s., Canadians at 4s. 9d. Oriental Telephone preference rose ⅛ on a small enquiry. The difficulty is to buy stock in any good-class concern; and would-be purchasers of £100 of this, that, or the other stock in the telegraph list have been disappointed, several times this week, in not being able to get their stock even at the higher of the prices quoted.

The armament group shows slackness, and there has been quiet pressure to sell Vickers and Armstrongs, no doubt on behalf of those who bought the shares lower down and are content to take profits. The rubber market received an unpleasant surprise early this week in the issue by one of the leading companies of new capital allotted to its proprietors by way of bonus, though the value of the gift was quickly modified by the market's putting down the price of the old shares to within a florin of the new. Rubber itself is steady, and the best-class shares attract a fair amount of investment attention in the provinces.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Month ended (4 wks.)	Receipts for the month.		No. of weeks.	Total to date.		Route miles open.	Inc.
		£	£		£	£		
Bath	Jan. 27	2,557	— 118	4	2,557	— 118	..	..
Blackpool-Fleetw'd	Feb. 6	1,136	+ 86	5	1,592	+ 51	8	..
Bristol	„ 5	33,194	+3,523	5	42,386	+ 3,653	80·5	..
Chatham and Dist.	Jan. 28	3,743	+ 557	4	3,743	+ 597	14·98	..
Dublin	„ 29	23,070	+2,194	4	23,070	+ 2,194	54·25	..
Cork	„ 28	1,714	— 61	4	1,714	— 61	9·89	..
Hastings	„ 28	2,785	— 201	4	..	— 202	19·8	..
Lancashire United	Feb. 3	5,885	— 94	42	7,890	— 77	42	..
Llandudno-Col. Bay	Jan. 29	673	+ 114	8	1,879	+ 163	6·5	..
Tyneside	„ 27	1,905	+ 123	4	1,905	+ 123	11	..
Anglo-Argentine	Feb. 4	200,337	—28,172	5	253,057	—31,519	..	..
Auckland	Jan. 15	22,164	—3,469	28	147,096	+11,558	25·42	1·06
Calcutta	Feb. 6	17,030	— 916	..	..	+ 1,998	..	..
Kalgoorlie, W.A.	Nov.	2,414	..	47	28,919	..	..	..
Madras	Dec. 31	3,725	— 132	52	44,441	+ 1,495	..	..
Montevideo	Jan.	32,443	—5,813	13	88,129	—13,967	..	..
Dublin-Lucan Rly.	Feb. 5	445	+ 6	5	581	— 8	7	..

ELECTRICITY ON THE RAND.

The following data, relating to electric generating plant and large winding engines installed on the Rand, were published in the *South-African Mining Journal* from figures compiled by the S.A. Institute of Electrical Engineers and presented to the S.A. Association for the Advancement of Science:—

Name of power supply company, mining company, or municipality owning generating plant.	Name of generating station.	No. of sets.	Makers' rating per set. KW.	Makers' name.	Type of plant.	Total capacity of station. KW.
The Victoria Falls and Transvaal Power Co., Ltd., and	Brakpan	2	3,000	A.E.G.	Turbine 3 phase	6,000
	Simmer Pan	6	3,000	A.E.G.	" "	
		2	11,000	A.E.G.	" "	40,000
The Rand Mines Power Supply Co., Ltd.	Robherville	5	9,600	A.E.G.	" "	48,000
	Vereeniging	2	9,600	A.E.G.	" "	
		2	12,000	A.E.G.	" "	43,200
	Total	19				137,200
Randfontein Estates Gold Mining Co., Witwatersrand, Ltd.	Randfontein Estates Power Station	3	6,000	1 Westinghouse 2 Parsons	Turbine 3-phase	
		3	2,000	Parsons	" "	26,000
		2	1,000	Parsons	" "	
East Rand Proprietary Mines, Ltd.	E.R.P.M. Central Power Station	3	1,150	Belliss & Morcom and G.E.C.	Reciprocating	
	Angelo Section	1	1,500	Parsons.	Turbine 3 phase	
		1	3,000	Willans and	" "	19,950
		1	6,000	Dick, Kerr	" "	
		1	6,600	A.E.G.	" "	
The Municipality of Johannesburg	Municipal Power Station, Johannesburg	3	3,000	Belliss & Morcom	Turbine 2-phase	
		1	1,000	"	Recip'g "	
		2	250	Allen	" "	
		2	1,000	Belliss & Morcom	Reciprocating	13,250
		2	500	"	Direct-current plant	
		1	250	Allen		
Kleinfontein Power Association	Kleinfontein Power Association, Central Power Station	3	2,000	Parsons	Turbine	6,000
The Langlaagte Estate and Gold Mining Co., Ltd.	Langlaagte Estate Power Station	1	85	Bruce Peebles	Reciprocating	
		3	400	A.E.G.	"	
		1	500	Siemens	"	2,085
		2	150	A.E.G.	"	
A. Goerz & Co., Ltd.	Geduld Proprietary Mines	1	800	Siemens	Exhaust steam turbo	800
	Princess Estate	1	170	"	Steam-driven	
		1	64	"	"	390
		1	160	"	"	
S. Neumann & Co., Ltd.	Witwatersrand Deep	1	1,000	Parsons	Turbine	
		1	750	Brit. W'house	Reciprocating	2,500
		1	500	Gen. Electric	Curtis turbine	
	Cons. Main Reef	1	1,000	Parsons	Turbine	
		2	250	Gen. Electric	Rope drive	1,500
	Wolhuter G.M. Co.	2	400	E.C.C. & B.G.E.	Rope-driven and recip.	800
	Knight Central	1	750	A.E.G.	Rope-driven	750
General Mining and Finance Corporation, Ltd.	Aurora West	1	160	Mather & Platt	Direct coupled	
		1	100	"	"	360
		1	100	E.C.C.	Rope-driven	
	Van Ryn	2	500	Brit. W'house	Reciprocating	1,375
		3	125	Mather & Platt	Rope-driven	
Krugersdorp Municipality	Power Station	2	225	Siemens	Reciprocating	450

Name of mine.	Name of supplier.	Type of winder.	No. and H.P. of motors per winder (continuous rating).	Maximum depth of wind.	Weight of rock per wind.	Complete trips per hour.	Voltage of winder motors.	Speed of winder motors.
Crown Mines, Ltd.	Electrical—G.E.C. of America. Mechanical—Fraser and Chalmers.	Ward-Leonard cylindro-conical drums.	Two 2,000 H.P. each motor.	3,540 ft. vertical.	8 tons.	44	1,000 v. across two motors in series.	53·5 R.P.M.
" "	Motor generators—Siemens. Winder motors—A.E.G. Mechanical—Fraser & Chalmers.	Two Ward-Leonard winders, cyl. con. drums.	Two 1,420-H.P. each motor.	2,260 ft. vertical.	8 tons.	45	1,000 v. across two motors in series.	53·5 R.P.M.
E.R.P.M. Hercules Shaft	British Westinghouse Co.	Ward-Leonard cyl. con. drums.	Two 750-H.P. each motor.	4,500 ft. vertical.	8 tons.	20	1,000 v. across two motors in series.	33·3 R.P.M.
Village Deep, Ltd., and City Deep, Ltd.	" "	Three-phase motors direct-coupled. (Two cyl. drum hoists. Four Whiting hoists.)	One 1,600-H.P.	3,600 ft. vertical.	5 tons.	32	2,000 v.—three-phase—50 cycles.	100 R.P.M.
Bantjes Consolidated Mines, Ltd.	Siemens.	Three-phase motor geared to cyl. drums.	One 1,470-H.P.	4,000 ft. incline.	5 tons.	23	2,000 v.—three-phase—50 cycles.	250 R.P.M.
Consolidated Langlaagte G.M. Co., Ltd.	"	Ward-Leonard (Two similar equipments.)	One 1,290-H.P.	1,230 ft. vertical and 3,000 ft. incline.	5 tons.	23	500 v. direct current across winding motor.	80 R.P.M.
New Modderfontein G.M. Co., Ltd.	A.E.G.	Three-phase motor, direct coupled to cyl. drums.	One 1,200-H.P.	2,000 ft.	3 tons.	45	2,000 v.—three-phase—50 cycles.	—

RUSSIA'S IMPORTATION OF ELECTRICAL GOODS.

The past few years have been characterised by a great rise in the importation of merchandise into Russia. The average for the five years 1909 13 was 1,004,000,000 roubles, against 646,000,000 roubles in the immediately preceding five years. The largest importation has been in finished goods; these rose by 92 per cent in the last five years named over the corresponding importations of the preceding five years, whereas the rise in the importation of raw materials in the same space of time was only 45 per cent. But no class of goods has shown such a great advance in the importation movement into Russia as the products of the electrical industry. The average annual importation during the last five years, compared with the preceding five years, has grown by about three times, or to 15 200 000 roubles value from 5,500 000 roubles. The following table (from the *Electritchestro*) shows the importation into Russia of electrical goods along with the importation of all other kinds of metal goods :—

TABLE I.—Ten Years' Importation into Russia.

	Electrical goods. Roubles.	All other goods made of metal. Roubles.
1904	4,472,000	96 167,000
1905	4,562 000	100,276,000
1906	5,567,000	106 969,000
1907	5,759,000	117.908,000
1908	7,073,000	129,616,000
1909	8,316,000	151,581,000
1910	10,888,000	186 006,000
1911	14,342,000	226 879,000
1912	17,014,000	229,201.000
1913	25,240,000	259,718,000

Thus, the table shows that the importation of both categories of goods has risen from year to year, but whereas the importation of electrical goods for the ten years figured in the table rose from 4,500,000 roubles value to 25,200,000 value, or, five and a half times, the importation of general metal goods rose only two and a half times.

Table II gives the importation of electrical products from the time of the introduction of the 1906 tariff according to classification. With the generally very significant increase in the consumption of electrical products, the importation from abroad of some goods in this group is relatively small, as the demand is covered by the home production. The importation of insulated copper wire for the past few years has not exceeded 10,000 poods; the demand for electrical cables is almost entirely supplied from the home production. In the year 1913 only 8,000 poods were imported, whilst 10 to 15 years ago the annual importation was about 150,000 poods. Similarly, the home manufacture provides accumulators and telephone and telegraph apparatus. Of the accumulators received of recent years, less than 2,000 poods have been imported, and of telephone and telegraph apparatus only 7,000 to 8,000 poods. German statistics show respecting this item that it is telephone apparatus rather than telegraph apparatus that is imported.

The importation of electric cars compared with the home production is insignificant; the number imported in 1913 was only 106. The total value of all the goods enumerated, namely, insulated wire, cables, accumulators, telephone and telegraph apparatus, and electric railway cars, in 1913, does not exceed 1,500,000 roubles out of a total importation of electrical goods valued at 25,200,000 roubles.

The importation of incandescent electric lamps amounted in 1913 to 30,000 poods against 5,600 poods in 1906, and the corresponding values were 4,600,000 roubles and 400,000 roubles respectively. It is mostly metal-filament lamps that are imported, namely, 23 000 poods against 4,000 poods with carbon filaments. Until the introduction of the law of May 28th, 1912, o.s., all lamps in cases paid a duty of 30 roubles per pood; but the law referred to made the duty 65 roubles per pood for metal-filament lamps.

Germany had an exceptional position in the supply of electric material to Russia. As can be seen from the following table, her part amounted to 80 per cent. to 90 per cent. of the importation, and the relative position of Germany improved year by year, whilst the importation from other countries improved at a very slow rate or did not improve at all. It was only in the importation of telephonic apparatus that Germany suffered very serious competition from Sweden.

TABLE II.—Classified List.

		1906.	1907.	1908.	1909.	1910.	1911.	1912.	1913.
Stranded copper wire covered with fibrous material, gutta-percha, rubber, &c. :—									
(*a*) 2 millimetres and upwards	poods	7,000	3,000	5,000	4,000	7,000	7,900	5,800	8,000
	roubles	232,000	122,000	167,000	144,000	251,000			
(*b*) Ditto, covered with silk or mixture of other fibrous material	poods	—	—	—	700	600	371,000	245,000	355,000
	roubles	12,000	11,600	16,000	27,000	27,000			
(*c*) Finer than 2 mm.... ...	poods	2,000	—	1,000	600	600	1,400	1,600	2,400
	roubles	56,000	20,000	24,000	25,000	30,000			
(*d*) Ditto, covered with silk or mixture of other fibrous material	poods	—	—	—	400	300	78,000	98,000	136,000
	roubles	15,000	21,000	15,000	26,000	27,000			
Electrical cables—all kinds ...	poods	192,000	16,000	34 000	8,000	14,000	13,000	9,500	8 000
	roubles	1,355,000	281,000	457,000	158,000	212,000	148,000	102,000	155,000
Electric locomotives	poods	—	—	2,000	300	300	1,300	7.100	3,500
	roubles	—	—	23,000	6,000	4,000	16,000	83,000	38,000
Dynamo-electric machines and electric motors—all kinds	poods	83,000	91,000	131,000	143,000	146,000	215,000	251,000	383,000
	roubles	1,526,000	2,143,000	3,155,000	3,584,000	4,157,000	5,373,000	5,947,000	9,595,000
Electrical transformers	poods	4.000	12,000	11,000	12,000	16,000	19,000	25 000	32,000
	roubles	80,000	251,000	259,000	237,000	334,000	465,000	478,000	704,000
Parts of electric machines and transformers :—									
(*a*) Bobbins ... ..., ...	poods	—	1,000	1,000	1,000	600	1,800	1,500	1,400
	roubles	16,000	28,000	59,000	48,000	29,000	73,000	66,000	65,000
(*b*) Armatures & commutators	poods	2,000	5,000	5,000	4,500	3,000	4,500	5,600	5,600
	roubles	64,000	143,000	169,000	137,000	103,000	146,000	183,000	168,000
(*c*) Carcasses with copper cover over bearing parts	poods	—	2,000	1,000	300	1,000	3,200	4,700	16,000
	roubles	5,000	38,000	22,000	7 000	26,000	78,000	116,000	488,000
(*d*) Telegraph and telephone apparatus	poods	5,500	6,200	5,300	5,800	7 000	7,600	7,900	8,400
	roubles	190,000	209,000	165,000	195,000	248,000	282 000	240,000	363 000
(*e*) Electric accumulators	poods	1,000	1,100	700	4 400	2,900	1,000	1 800	1,900
	roubles	11,000	21,000	12,000	80,000	75,000	28,000	50,000	58,000
Electrical switches, keys, fuses, lamp sockets and rheostats assembled or not, electric bells, electric signal parts	poods	24.000	31,000	37,000	46,000	65,000	105,000	140,000	230,000
	roubles	727,000	879,000	990,000	1,462,000	1,983,000	3,036,000	3,849,000	6,602,000
Electrical measuring apparatus, ammeters, wattmeters and voltmeters	poods	4,700	7,000	8,400	11,000	15 000	21,000	27,000	33.000
	roubles	215,000	335,000	354,000	493,000	702 000	940,000	1,183,000	1,452,000
Electric incandescent lamps in cases	poods	5,600	7 800	10 000	13 000	18,000	23 000	30,000	* 27,000
	roubles	396,000	748,000	1,029,000	1,515,000	2,251,000	2,613,000	3,798,000	4,619,000
Electric incandescent lamps without cases	poods	100	—	—	—	—	—	—	—
	roubles	11,000	2,000	1,000	2,000	1,000	2,000	10,000	2,000
Electrical railway cars, large ...	units	84	63	40	63	89	150	184	106
	roubles	656,000	507,000	156,000	170,000	448,000	693,000	566 000	440,000
Total value in 1,000's of roubles ...		5,567	5,759	7,073	8,316	10,888	14,342	17,014	25,240

* This includes lamps with carbon filaments, 4,000 poods, and with metal filaments, 23 000 poods.

Recently published data show that the movement has continued even into the year 1914. Thus, from January to July the figures were 14,852 000 roubles, against 12,142,000 roubles in the first seven months of 1913, and 9,460,000 roubles in the first seven months of 1912.

Great attention, says the article, must be paid to the exceptional importation of some goods when the new treaties come to be made after the war. Incandescent lamps, for example, may be made easier to be produced in Russia by the imposition of higher tariffs. Germany's electrical business profits principally by the free impor-

tation of copper. In Russia the duty on copper in 1905 was 3 roubles 75 copecks to 5 roubles per pood; and the price is one and a half times dearer than in Germany or England, notwithstanding the increase in the smelting of copper in Russia itself.

TABLE III.—Importation per Country in 1,000's of Poods.

Figures per country for 1913 not yet published.

	1908.	1909.	1910.	1911.	1912.
Dynamo machines and electro-motors.—					
From Germany	112·4	125·9	138·0	192 2	226·6
,, Great Britain ...	12 1	16·3	4 9	18·4	16·5
,, Austria-Hungary ...	3·6	1·4	1 8	2 8	7·7
,, France	0·7	1·8	1 3	2 5	1·3
,, Belgium	2·4	0 1	0 5	3·4	0·1
,, Sweden	0·1	0·5	1·7	2·8	1·7
,, United States of America... ...	0·1	0·7	3·0	0 6	4·7
,, Finland	0·4	0·3	0 9	1·8	2 9
,, Other countries ...	1·2	1·4	1·4	2·0	0·8
	133·0	148 4	153 5	226·5	262·3
Electrical transformers.—					
From Germany	8·7	9 3	14 6	15 3	23·3
,, Great Britain ...	0 8	1·1	0·7	2·9	1·8
,, Austria-Hungary ...	1 0	0·3	0 2	0·2	0 3
,, France	0 1	0 6	0 6	—	—
,, Holland	—	0·2	—	0·3	—
,, Other countries ...	0 1	—	0·2	0 3	0·8
	10·7	11·5	16·3	19·0	26·2
Electrical switches, keys, fuses, &c., bells, rheostats, &c.—					
From Germany	39 8	40 5	60·7	95 0	130 4
,, Great Britain ...	2·0	3 2	1·6	5 2	4 0
,, Austria-Hungary	1·5	1·4	2·6	3·1	5·4
,, France	0·4	0 6	1·2	0 9	1 0
,, Sweden	0 1	0·2	0·2	0 8	1·0
,, Belgium	1 6	—	0 5	1·7	1 6
,, United States of America ...	0·1	1·1	0·1	1 3	0 6
,, Other countries ...	0·7	0 9	0·6	1·2	1·4
	46 2	47 9	67·5	109·2	145·4
Electrical measuring apparatus.—					
From Germany	8·1	10·4	15·1	20 4	26·2
,, Great Britain ...	0·1	0 1	0·4	0·6	0 3
,, Austria-Hungary	0 1	0·4	0 1	0 1	0 4
,, France	0·1	0 2	0·2	0 2	0 3
	8·4	11 1	15 8	21·3	27·2
Electrical incandescent lamps in cases.—					
From Germany... ...	8 6	10·5	15 8	19·4	19·1
,, Great Britain ...	0·1	0·2	0·4	0·8	0·1
,, Austria-Hungary	1·5	1 6	2·1	3·1	1·9
,, Holland	0 2	0·3	0 2	0 5	0 1
,, France	0 2	0·1	0 1	0 1	0 1
,, Sweden	0·1	0·3	0 2	0·1	0 1
,, Other countries...	0·3	0·2	0·1	0 2	0·1
	11·0	13·2	18 9	24·2	21·5
Telegraph and telephone apparatus.—					
From Germany	1·2	2 6	2 9	3·6	4 2
,, Sweden	2 8	2 4	2 9	2·9	2 7
,, Great Britain ...	0 2	0·2	0 1	0·2	0·1
,, Austria-Hungary	0 8	0·5	0·6	0·5	0·4
,, Denmark	0·3	0·4	0·1	0 3	0 4
,, Belgium	0·1	—	—	—	—
,, Finland	0 1	0 4	0·5	0 3	0·2
,, Other countries ...	—	0·2	0 2	—	0·1
	5·5	6 7	7 3	7·8	8·1
Electric railway cars.—			Units.		
From Germany	25	63	72	78	131
,, Great Britain ...	15	—	—	—	4
,, Austria Hungary...	—	—	7	17	9
,, Belgium	—	—	10	55	50
	40	63	89	150	194

The first position in the list of imports is occupied by dynamo-electric machines and electromotors, the importation which has increased steadily for years—namely, from 83 000 poods, value 1,500,000 roubles, in 1903, to 383,000 poods, value 9,600,000 roubles, in 1913. The importation of transformers during 1913 was 32,000 poods' weight, of value 704,000 roubles. Dynamos and transformers bear a Customs duty of 8 roubles 50 copecks per pood, or from 30 to 36 per cent. on the value; but parts of dynamos, machines and transformers are imported to a very slight extent. The second position in the list is occupied by sundry items grouped under one tariff and statistical denomination—electrical switches, keys, fuses, incandescent lamp sockets, rheostats and commutators of all kinds, complete and in parts, electric and pneumatic bells, and accessories for electrical signalling, the importation of which in the year 1913 amounted to 230,000 poods, value 6,600,000 roubles, against 24,000 poods, value 700,000 roubles only, in 1906. All these goods bear a duty of 9 roubles per pood or 28 to 33 per cent. of their gross value.

The importation of electrical measuring instruments, amperemeters, wattmeters, voltmeters, &c., during the year 1913 made a total of 1,500,000 roubles' value, against only 200,000 roubles' value seven years before. The duty on these is 12 roubles per pood or 26 to 28 per cent. of the imported value.

TRADE STATISTICS OF CANADA.

The following figures, showing the imports into and exports from Canada of electrical and similar materials during the year ended March 31st, 1914, are taken from the recently issued trade statistics. Figures for the year 1912-13 are given for purposes of comparison, and notes of any increases or decreases have been added.

Imports.

	1912-13 Dollars.	1913-14 Dollars.	Inc. or Dec. Dollars.
Railway passenger cars.—			
From United States ...	303,000	2,067,000	+ 1,764,000
Tram or horse cars.—			
From United States ...	2,000	37,000	+ 35,000
Copper wire, plain, tinned or plated.—			
From United Knigdom ...	1,000	1,000	—
,, United States ...	105,000	115,000	+ 10,000
Total	106,000	116,000	+ 10,000
Electric light carbons and carbon points.—			
From United Kingdom ...	4,000	5,000	+ 1,000
,, Germany	24,000	40,000	+ 16,000
,, United States ...	41,000	39,000	— 2,000
,, Other countries ...	2,000	5,000	+ 3,000
Total	71,000	89,000	+ 18,000
Electric apparatus not mentioned—insulators, batteries, telegraph & telephone instruments.—			
From United Kingdom ...	987,000	809,000	— 178,000
,, Austria	2,000	2,000	—
,, France	13,000	29,000	+ 16,000
,, Germany	77,000	141,000	+ 64,000
,, Sweden	50,000	80,000	+ 30,000
,, United States ...	5,849,000	5,515,000	— 334,000
,, Switzerland ...	2,000	3,000	+ 1,000
,, Other countries ...	16,000	18,000*	+ 2,000
Total	6,996,000	6,597,000	— 399,000

* Italy $5,000.

Incandescent lamp bulbs, etc.—			
From Austria	25,000	14,000	— 11,000
,, United States ...	111,000	110,000	— 1,000
,, Other countries ...	10,000	8,000	— 2,000
Total	146,000	132,000	— 14,000
Electric motors and generators.—			
From United Kingdom ...	193,000	136,000	— 57,000
,, France	4,000	4,000	—
,, Sweden	68,000	103,000	+ 35,000
,, United States ...	1,313,000	1,542,000	+ 229,000
,, Other countries ...	6,000	22,000†	+ 16,000
Total	1,584,000	1,807,000	+ 223,000

† Germany $14,000.

Lamp chimneys, glass shades and globes.—			
From United Kingdom ...	8,000	6,000	— 2,000
,, Austria	18,000	23,000	+ 5,000
,, Germany	35,000	50,000	+ 15,000
,, United States ...	361,000	304,000	— 57,000
,, Other countries ...	3,000	3,000	—
Total	425,000	386,000	— 39,000
Gasoline engines.—			
From United Kingdom ...	107,000	111,000	+ 4,000
,, United States ...	3,301,000	2,457,000	— 844,000
,, Other countries ...	6,000	2,000	— 4,000
Total	3,414,000	2,570,000	— 844,000
Manufactures of india-rubber and gutta-percha, except tires, clothing and similar goods.—			
From United Kingdom ...	218,000	231,000	+ 13,000
,, Austria	12,000	15,000	+ 3,000
,, France	8,000	9,000	+ 1,000
,, Germany	60,000	61,000	+ 1,000
,, United States ...	753,000	776,000	+ 23,000
,, Other countries ...	—	5,000	+ 5,000
Total	1,051,000	1,097,000	+ 46,000

	1912-13. Dollars.	1913-14. Dollars.	Inc. or Dec. Dollars.
Rubber belting.—			
From United Kingdom ...	15,000	4,000	— 11,000
,, United States ...	109,000	84,000	— 25,000
Total	124,000	88,000	— 36,000
Steam engines.—			
From United Kingdom ...	117,000	50,000	— 67,000
,, United States ...	459,000	386,000	— 73,000
,, Italy	—	19,000	+ 19,000
Total	576,000	455,000	— 121,000
Steam boilers.—			
From United Kingdom ...	74,000	112,000	+ 38,000
,, United States ...	323,000	273,000	— 50,000
Total	397,000	385,000	— 12,000
Concrete mixing, cement making, and coal handling machines.—			
From United Kingdom ...	*	32,000	—
,, United States ...	*	459,000	—
,, Other countries ...	—	4,000	—
Total	*	495,000	—

* Not separately mentioned.

All machinery not mentioned, except sewing machines, textile machinery, printing machinery, etc.—			
From United Kingdom ...	2,015,000	1,702,000	— 313,000
,, France	7,000	79,000	+ 72,000
,, Germany	209,000	163,000	— 46,000
,, United States ...	17,485,000	12,811,000	— 4,674,000
,, Other countries ...	73,000	67,000	— 6,000
Total	19,789,000	14,822,000	— 4,967,000
Iron and steel wire, single or several, covered with cotton, linen, silk, rubber, or other material, including cables so covered.—			
From United Kingdom ...	434,000	304,000	— 130,000
,, United States ...	774,000	563,000	— 211,000
,, Other countries ...	12,000	11,000	— 1,000
Total	1,220,000	878,000	— 342,000
Iron and steel wire not mentioned (except fencing wire).—			
From United Kingdom ...	16,000	17,000	+ 1,000
,, Germany	6,000	23,000	+ 17,000
,, United States ...	301,000	244,000	— 57,000
,, Other countries ...	1,000	—	— 1,000
Total	324,000	294,000	— 30,000
Lighting fixtures of metal (including electric).—			
From United Kingdom ...	51,000	31,000	— 20,000
,, Austria	4,000	8,000	+ 4,000
,, United States ...	709,000	637,000	— 72,000
,, Other countries ...	17,000	29,000	+ 12,000
Total	781,000	705,000	— 76,000
Asbestos manufactures.—			
From United Kingdom ...	44,000	50,000	+ 6,000
,, United States ...	443,000	415,000	— 28,000
,, Other countries ...	10,000	9,000	— 1,000
Total	497,000	474,000	— 23,000
Plumbago, ground and manufactured.—			
From United Kingdom ...	8,000	14,000	+ 6,000
,, United States ...	50,000	47,000	— 3,000
Total	58,000	61,000	+ 3,000

Mica.—	Exports.		
To United Kingdom ...	37,000	36,000	— 1,000
,, United States	282,000	156,000	— 126,000
,, Other countries ...	2,000	17,000	+ 15,000
Total	321,000	209,000	— 112,000
Electrical apparatus.—			
To United Kingdom ...	12,000	25,000	+ 13,000
,, Newfoundland	9,000	9,000	—
,, United States	188,000	67,000	— 121,000
,, Other countries ...	7,000	6,000	— 1,000
Total	216,000	107,000	— 109,000
Machinery (other than sewing machines and typewriters).—			
To United Kingdom ...	66,000	84,000	+ 18,000
,, Newfoundland	112,000	56,000	— 56,000
,, New Zealand	5,000	9,000	+ 4,000
,, Argentina	25,000	9,000	— 16,000
,, France	20,000	23,000	+ 3,000
,, United States	806,000	729,000	— 77,000
,, Other countries ...	68,000	76,000	+ 8,000
Total	1,102,000	986,000	— 116,000

CABLES.

The paper on "Cables," read before the Scottish Local Section of the Institution of Electrical Engineers by Mr. C. J. Beaver, was discussed at a meeting in Edinburgh on Jan. 12th. (For abstract of the paper, see Elec. Rev., Nov. 20th and 27th and Dec. 4th, 1914).

Mr. D. A. Starr (Glasgow) thought it very doubtful whether in Britain a 50 or 100-kilovolt transmission scheme could be justified. The plant capacity required for charging the cables alone would present difficulties which considerations of sound finance could scarcely surmount. Having regard to our extensive coalfields and our readily accessible seaboard, it would seem to be a sounder proposition to select a power station site with abundant condensing water and the use of seaborne coal, and to generate at a pressure not exceeding 20,000 volts rather than to select a site at a remote coalfield and transmit at 50,000 or 100,000 volts. It was a common experience with three-core paper-insulated cables which had been so built as not to exclude all interstices in which air might find a lodgment, that serious troubles arose at the end boxes due to the imprisoned air expanding under rising temperature. This air found its easiest escape through the compound in the end boxes, leaving a pin hole in its path through which damp air might be drawn when the temperature of the cable returned to normal. Very often the end-box design was blamed for what was really an inherent defect in the design or the manufacture of the cable. The general impression amongst engineers in this country was that pure manilla paper only should be used for cable manufacture; Dr. Borel had expressed the opinion that a pure manilla paper was much inferior to a manilla with a small proportion of wood pulp, stating that pure manilla was not sufficiently porous to absorb the necessary quantity of the insulating oil or compound, and that from his experience extending over many years he did not approve of pure manilla. Regarding the case of alleged mechanical damage at Manchester, it would appear that the trouble experienced was more likely to be caused by the accession of moisture through the joints in the troughing assisted, probably, by the presence of cable supports. It seemed highly improbable that the cable and troughing would be displaced, as obviously the ground under the troughing must have yielded by a corresponding amount. The corrosion of lead sheathing at troughing joints was no new phenomenon, and could easily be got over by a modification of the design of support used for keeping the cable central with the troughing. The real danger of wooden bridge pieces lay in the fact that it was almost impossible to eliminate the free acids in the wood. In the Ruthven-Murray bridge-piece steel was used, and the support was so shaped as to sling the cable from the sides of the trough. Owing to the temporary failure of an important feeder the remaining feeders might be required to transmit considerably more than their normal current for several hours; whilst paper-insulated cables could withstand such abnormal conditions without detriment, bitumen cables were sometimes irreparably damaged due to the conductors becoming decentralised through overheating. For this reason their use could not be recommended except in cases where they had to perform some well-defined service, and where discriminating cut-outs could be depended upon to protect them from themselves.

Mr. J. M. Munro (Glasgow) said that the lead sheathing of cables was returning to its own again now that safeguards were provided against leakage of current on to and from the sheath. But the inelasticity of lead and its consequent tendency to harden and creep and crack under mechanical stresses due to vibration, temperature variation or rough handling somewhat limited its use. Equipotential points also altered, not only with the growth of a network, but hourly with the diversity of load. It was disconcerting to hear of the hydrolysis of vulcanised bitumen, but he still imagined that moisture, even if slightly alkaline, but without current leakage, would not deeply injure vulcanised bitumen within any period of time likely to trouble the engineer who laid the cable. In all kinds of cable he set store by the filling of interstices between the wires of the core. There was need also for non-hygroscopic coverings to take the place of tape and braiding. Perhaps bitumen should be more largely used as a loading for rubber mixtures for cables, while what was known as cab-tire sheathing seemed likely to prove itself a distinct addition to the resources of those responsible for cables other than the underground type.

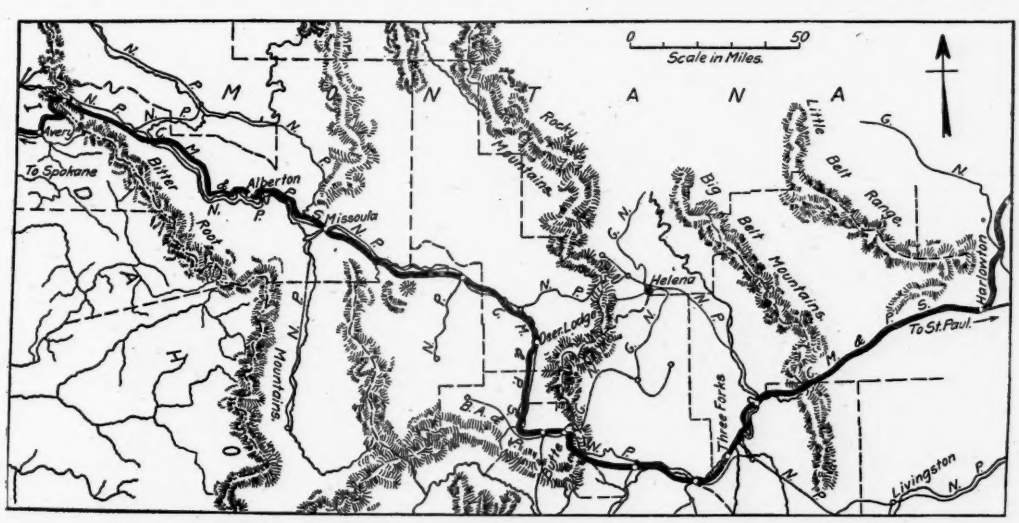
Mr. R. B. Mitchell pointed out that the author, in referring to cables suitable for pressures of 20 kilovolts, stated that makers had found no difficulty in keeping the dimensions of their cables within the limits of ordinary installation practice. It seemed to him that if the present British standards were adhered to, *i.e.*, if cables for 20 to 30 kilovolts had dielectric thickness in proportion to existing standards for 6 and 11 kilovolts, the result would be cables of unwieldy proportions. He found that a .2 sq. in. 3-core cable lead-covered and armoured for 30,000 volts could not be drawn into a 4 in. duct; without the armour it could be. The limiting size seemed to him to be that which could be got into a 4 in. duct. It had been suggested to him that 11,000-volt cable made to British standards would work quite safely at 20,000 volts. Time would show if that opinion was correct. The author stated that there was a much better chance of making a lead-sleeve joint watertight than a cast-iron box; but the wiped joints on

lead sleeves could not always be relied upon, even if the highest class of labour was employed. In Glasgow this difficulty had been got over; a cast-iron sleeve was used, the ends being joined solid on to the lead and armour of the cable by means of cast lead, *i.e.*, lead in a molten state was run into a mould placed round the cable and sleeve. An absolutely watertight joint was obtained which would stand a water pressure over 100 lb.; no special labour was required, and there was no uncertainty as to the result as was the case with wiped joints. These joints were used not only for high-tension work, but also for services upon low-tension lead-covered and armoured cables laid direct in the ground. The results obtained in Glasgow with bitumen cables had been excellent in cases where the solid system had been used, but where the cables were drawn into ducts the results had been unsatisfactory, more particularly with small cables. The arc lamp circuits over the whole city were composed of bitumen cables drawn into iron pipes. The bitumen was found to crack in some cases and to soften in others.

In the course of his reply, Mr. Beaver assured Mr. Starr that very high-pressure cables were in contemplation; they were referred to in Messrs. Merz and Maclellan's report on the London systems, and he would not be surprised if the Newcastle district pressures, which had been pioneers up till now at 20,000 volts, would eventually be increased to 50,000 volts. The difficulty of providing charging currents was undoubtedly against them ever being used in very long lengths, but there would be quite a field for them apart from long lengths. Where the conditions were such as to permit of 50,000 to 100,000 volts pressure they would find that the conditions also allowed of overhead transmission. He did not agree that a paper containing a proportion of wood pulp would be better than a pure manilla paper. The improvement which had been made in the materials of vulcanised-bitumen cables militated much against their being damaged by overloading. Expansion defects which arose in the lead covering of cables were negligible, because they would be confined to some unfavourable place and the cable would go down in these places long before it suffered very generally. On the point of the association of rubber and bitumen and their mutual action, the addition of 10 per cent. of rubber to vulcanised bitumen showed practically no difference.

3,000-VOLT D.C. ELECTRIFICATION OF THE PUGET SOUND LINES OF THE CHICAGO, MILWAUKEE, AND ST. PAUL RAILWAY.

Plans for the electrification of the first engine division of the Chicago, Milwaukee and St. Paul Railway have now been completed and contracts let to the General Electric Co., of Schenectady, N.Y., for the electric locomotives, sub-station apparatus and line material, and to the Montana Power Co. for the construction of the transmission and trolley lines.



The Avery-Harlowton Section of the Chicago, Milwaukee and St. Paul Railway.

This initial electrification of 113 miles of main line between Three Forks and Deer Lodge is the first step toward the electrification of four engine divisions extending from Harlowton, Montana, to Avery, Idaho, a total distance of approximately 440 miles, aggregating about 650 miles of track, including yards and sidings. While this comprises the extent of track to be equipped in the near future, it is understood that plans are being made to extend the electrification from Harlowton to the coast, a distance of 850 miles, should the operating results of the initial installation prove as satisfactory as anticipated.

The plans of the Chicago, Milwaukee and St. Paul Railway are of especial interest, as this is the first attempt to install and operate electric locomotives on tracks extending over several engine divisions, under which conditions it is claimed the full advantage of electrification can be secured. The various terminal and tunnel installations have been made necessary, more or less, by reason of local conditions; but the electrification of this road is undertaken purely on economic grounds with the expectation that superior operating results with electric locomotives will effect a sufficient reduction in the present cost of steam operation to return an attractive percentage on the large investment required.

The success of electric operation on such a large scale will, at least, settle the engineering and economic questions that enter into the advisability of making such an installation, and will limit similar future problems to the means of raising the money expenditure required.

The first step taken towards electrification by the Chicago, Milwaukee and St. Paul Railway was to enter into a contract with the Montana Power Co. for an adequate supply of power over the 440 miles of main line considered for immediate electrification. The precautions taken both by the railway company and power company to safeguard the continuity of power supply should guarantee a reliable source of power subject to few interruptions of a momentary nature only.

The Montana Power Co. covers a great part of Montana and part of Idaho with its network of transmission lines, which are fed from a number of sources with a total power capacity developed and undeveloped of 244,000 kw. The several power sites are inter-connected by transmission lines, supported on wooden poles and operating at 50,000 volts for the earlier installations, and on steel towers and operating at 100,000 volts for later installations.

Due to the great facilities available and the low cost of construction under the favourable conditions existing, the railway company will purchase power at a contract rate of $0.00536 per kw.-hour based on a 60 per cent. load factor. It is expected under these conditions that the cost of power for locomotives will be considerably less than is now expended for coal. The contract between the railway and power companies provides that the total electrification between Harlowton and Avery, comprising four engine divisions, will be in operation January 1st, 1918.

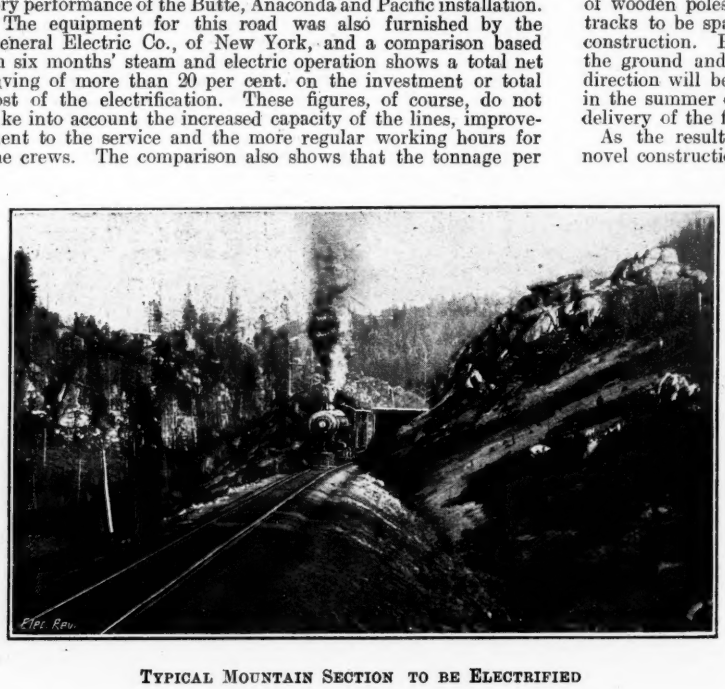
In order to connect the sub-stations with the several feeding-in points of the Montana Power transmission lines, a tie-in transmission line is being built by the railway company that will permit feeding each sub-station from two directions and from two or more sources of power. This transmission line will be constructed with wooden poles and suspension type insulators, will operate at 100,000 volts and will follow, in general, the right of way of the railway company except where advantage can be taken of a shorter route over public domain to avoid the necessarily circuitous line of the railway in the mountain districts.

The immediate electrification of 113 miles will include four sub-stations containing step-down transformers and motor-generator sets with necessary controlling switchboard appa-

ratus to convert 100,000-volt 60-cycle three-phase power to 3,000 volts direct current. This is the first direct-current installation using such a high pressure as 3,000 volts, and this system was adopted in preference to all others after a careful investigation extending over two years. The 2,400 volt direct-current installation of the Butte, Anaconda and Pacific Railway in the immediate territory of the proposed Chicago,

Milwaukee and St. Paul electrification has furnished an excellent demonstration of high-voltage direct-current locomotive operation during the past year and a half, and the selection of direct-current at 3,000 volts for the Chicago, Milwaukee and St. Paul was due in a large measure to the entirely satisfactory performance of the Butte, Anaconda and Pacific installation.

The equipment for this road was also furnished by the General Electric Co., of New York, and a comparison based on six months' steam and electric operation shows a total net saving of more than 20 per cent. on the investment or total cost of the electrification. These figures, of course, do not take into account the increased capacity of the lines, improvement to the service and the more regular working hours for the crews. The comparison also shows that the tonnage per train has been increased by 35 per cent., while the number of trains has been decreased by 25 per cent. with a saving of 27 per cent. in the time required per trip.



Typical Mountain Section to be Electrified

The sub-station sites of the Chicago, Milwaukee and St. Paul electrified zone provide for an average intervening distance of approximately 35 miles, notwithstanding that the first installation embraces 20.8 miles of 2 per cent. grade westbound and 10.4 miles of 1.66 per cent. grade eastbound over the main range of the Rocky Mountains. With this extreme distance between sub-stations and considering the heavy traffic and small amount of feeder copper to be installed, it becomes apparent that such a high potential as 3,000 volts direct current permits of a minimum investment in sub-station apparatus and considerable latitude as to location sites.

The sub-stations will be of the indoor type, the transformers being three-phase, oil cooled, and reducing from 100,000 volts primary to 2,300 volts secondary, at which potential the synchronous motors will operate. The transformers will be rated at 1,900 and 2,500 KVA. and will be provided with four 2½ per cent. taps in the primary and 50 per cent. starting taps in the secondary.

The motor-generator sets will comprise a 60-cycle synchronous motor driving two 1,500 volt direct-current generators connected permanently in series for 3,000 volts. The fields of both the synchronous motor and direct-current generators will be separately excited by small generators direct connected to each end of the motor-generator shaft. The direct-current generators will be compound wound, will maintain constant potential up to 150 per cent. load, and will have a capacity for momentary overloads up to three times their normal rating. To insure good commutation on these overloads, the generators are equipped with commutating poles and compensating pole-face windings. The synchronous motors will also be utilised as synchronous condensers, and it is expected that the transmission line voltage can be so regulated thereby as to eliminate any effect of the fluctuating railway load.

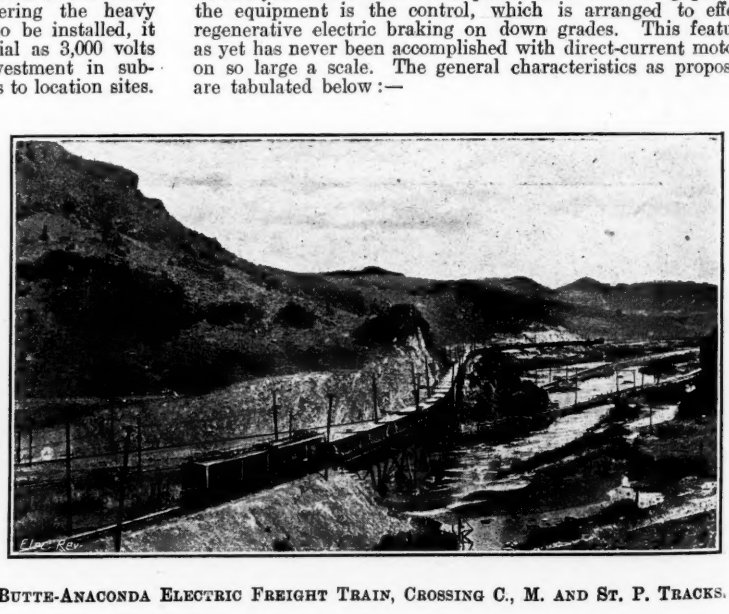
The location and equipment of the several sub-stations is as follows:—

Station.	Miles from Deer Lodge.	No. of Units.	Kw. per Unit.	Total.
Morel	... 17.1	2	2,000	4,000
Janey	... 50.5	3	1,500	4,500
Piedmont ...	... 77.9	3	1,500	4,500
Eustis	... 120.6	2	2,000	4,000

The trolley construction will be of the catenary type, in which a 4/0 trolley wire is flexibly suspended from a steel catenary supported on wooden poles, the construction being bracket wherever track alignment will permit and cross-span on the sharper curves and in yards. Steel supports instead of wooden poles will be used in yards where the number of tracks to be spanned exceeds the possibilities of wooden pole construction. Poles for the first installation are already on the ground and thirty miles of poles are set. Work in this direction will be pushed with all speed and will be completed in the summer of 1915, ready for operation in the fall on the delivery of the first locomotives.

As the result of careful investigation and experiments, a novel construction of trolley will be installed, composed of the so-called twin-conductor trolley. This comprises two 4/0 wires suspended side by side from the same catenary by independent hangers alternately connected to each trolley wire. This form of construction permits the collection of very heavy currents by reason of the twin contact of the pantograph with the two trolley wires, and also insures sparkless collection under the extremes of either heavy current at low speed or more moderate current at very high speeds. It seems that the twin-conductor type of construction is equally adapted to the heavy grades calling for the collection of very heavy currents, and on the more level portions of the profile where maximum speeds of 60 m.p.h. will be reached with the passenger trains having a total weight of over 1,000 tons. The advantage of this type of construction is due partly to the greater surface for the collection of current, but largely to the very great flexibility of the alternately suspended trolley wires, a form of construction which eliminates any tendency to flash at the hangers either at low or high speed. Including sidings, passing and yard tracks, the 113 miles of route mileage is increased to approximately 168 miles of single track to be equipped between Deer Lodge and Three Forks in the initial installation.

The locomotives to be manufactured by the General Electric Co. are the first to be constructed for railroad service with direct-current motors designed for so high a potential as 3,000 volts. They will weigh approximately 260 tons and will have a continuous capacity greater than any steam or electric locomotive yet constructed. Perhaps the most interesting part of the equipment is the control, which is arranged to effect regenerative electric braking on down grades. This feature as yet has never been accomplished with direct-current motors on so large a scale. The general characteristics as proposed are tabulated below:—

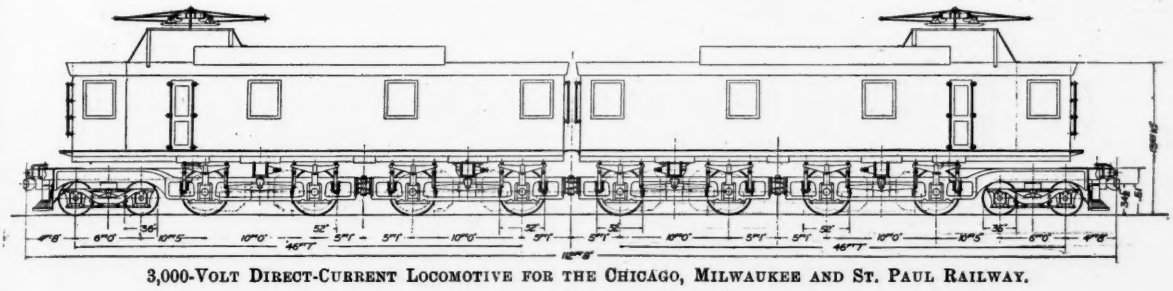


Butte-Anaconda Electric Freight Train, Crossing C., M. and St. P. Tracks.

Total weight	260 tons.
Weight on drivers	200 tons.
Weight on each guiding truck	30 tons.
Number of driving axles	8
Number of motors	8
Total length of locomotive	112 ft.
Rigid wheel base	10 ft.
Voltage per motor	1,500
H.P. rating one hour—complete locomotive ...	3,440
H.P. rating continuous—complete locomotive	3,000
Trailing load capacity, 2 per cent. grade ...	1,250 tons.
Trailing load capacity, 1 per cent. grade ...	2,500 tons.
Approximate speed at these loads and grades ...	16 m.p.h.

The Chicago, Milwaukee and St. Paul Railway, from Harlowton to the coast, crosses four mountain ranges: the Belt Mountains at an elevation of 5,768 ft., the Rocky Mountains at an elevation of 6,350 ft., the Bitter Root Mountains at an elevation of 4,200 ft., and the Cascade Mountains at an elevation of 3,010 ft. The first electrification between Three Forks and Deer Lodge calls for locomotive operation over 20.8 miles of 2 per cent. grade between Piedmont and Donald at the crest of the main Rocky Mountain Divide, so that the locomotives will be fully tested out as to their capacity and general service performance in overcoming the natural obstacles of the first engine division.

The initial contract calls for nine freight and three passenger locomotives having the above characteristics and similar in all respects, except that the passenger locomotives will be provided with a gear ratio permitting the operation of 800-ton



3,000-Volt Direct-Current Locomotive for the Chicago, Milwaukee and St. Paul Railway.

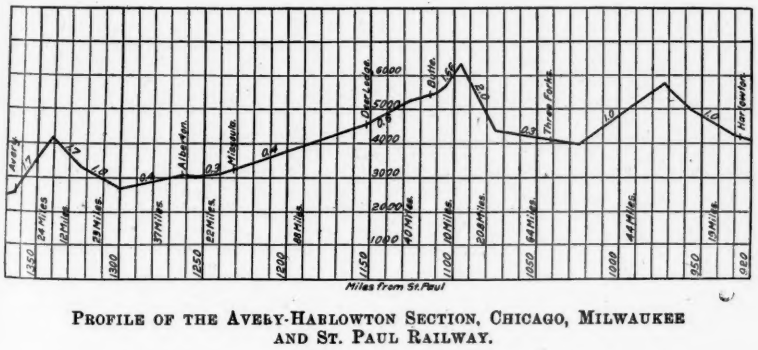
trailing passenger trains at approximately 60 m.p.h., and will, furthermore, be equipped with an oil-fired steam heating outfit for the trailing cars. The interchangeability of all electrical and mechanical parts of the freight and passenger electric locomotives is considered to be of very great importance from the standpoint of operation and maintenance.

The cab consists of two similar sections extending practically the full length of the locomotive. Each section is approximately 52 ft. long and the cab roof is about 14 ft. above the rail exclusive of the housing for ventilation. The trolley bases are about 5 ft. above the roof, owing to the unusual height of the trolley wire, which will be located at a maximum elevation of 25 ft. above the rail. The outer end of each cab will contain a compartment for the engineer, while the remainder is occupied by the electric control equipment, train heater, air brake apparatus, etc.

The eight motors for the complete locomotive will be type GE—253—A. This motor has a normal one-hour rating of 430 h.p. with a continuous rating of 375 h.p. The eight motors will thus give the locomotive a one-hour rating of 3,440 h.p. and a continuous rating of 3,000 h.p., which makes it more powerful than any steam or electric locomotive ever built. The drawbar pull available for starting trains will approximate 120,000 lb. at 30 per cent. coefficient of adhesion.

Each motor will be twin-geared to its driving axle in the same manner as on the Butte, Anaconda and Pacific, the Detroit River Tunnel and the Baltimore and Ohio locomotives, a pinion being mounted on each end of the armature shaft. The motor is of the commutating pole type and has openings for forced ventilation from a motor-driven blower located in the cab.

The freight locomotives are designed to haul a 2,500-ton trailing load on all gradients up to 1 per cent. at a speed of approximately 16 m.p.h., and this same train load unbroken will be carried over the 1.66 and 2 per cent. ruling grades on



Profile of the Avery-Harlowton Section, Chicago, Milwaukee and St. Paul Railway.

the west and east slopes of the Rocky Mountain Divide with the help of a second similar freight locomotive acting as pusher. Track provision is being made at Donald, the summit of the grade, to enable the pusher locomotive to run around the train and be coupled to the head end to permit electric braking on the down grade. In this case, the entire train will be under compression and held back by the two locomotives at this head end, the entire electric braking of the two locomotives being under the control of the motorman in the operating cab of the leading locomotive. It is considered that electric braking will prove very valuable in this mountain railroading, for, in addition to providing the greatest safety in operation, it also returns a considerable amount of energy to the sub-stations and transmission system, which can be utilised by other trains demanding power. In this connection, the electric locomotives will have electric braking capacity sufficient to hold back the entire train on down grade, leaving the air brake equipment with which they are also equipped to be used only in emergency and when stopping the train. There is, therefore, provided a duplicate braking system on down grades, which should be reflected in the greatest safety of operation afforded and the elimination of a considerable part of break-downs, wheel and track wear and overheating with consequent reduction in maintenance and improvement in track conditions.

With the completion of the remaining engine divisions, it is proposed to take advantage of the possibilities afforded by the introduction of the electric locomotive by combining the present four steam engine divisions into two locomotive divisions of approximately 220 miles length, changing crews, however, at the present division points. As the electric locomotive needs inspection only after a run of approximately 2,000 miles, requires no stops for taking on coal or water, or layover due to dumping ashes, cleaning boilers or petty roundhouse repairs, it is expected that the greater flexibility of the locomotive so provided will result in considerable change in the method of handling trains now limited by the restrictions of the steam engine.

In conclusion, we are indebted to the British Thomson-Houston Co., Ltd., whose allied concern in America is to carry out the contract, for the above particulars.

ELECTRIC STEEL-MAKING FURNACES.

By T. D. ROBERTSON.

(*Abstract of paper read before the* Institution of Electrical Engineers, *at Manchester, January 26th,* 1915.)

The first electric furnaces to work on a commercial scale were all constructed about 1899, and all took their power from water-driven plants. These were the Stassano furnaces in Italy, the Héroult in Savoy, and the Kjellin in Sweden; from these three types have developed the three main classes of electric steel furnaces now in use.

In the earlier types of induction furnace the metal bath is in the shape of a ring, which is really the short-circuited secondary winding of a transformer contained in the body of the furnace itself. An example of this class is the Kjellin furnace. The disadvantage of this type lies in the fact that some of the molten metal must be left in the furnace at the conclusion of every "heat" in order that a complete circuit may be maintained to start the furnace again. Cold materials to form the charge are added to this residual metal, and a covering of slag is made to protect the charge from atmospheric oxidisation. Owing to the difficulty of keeping a suitable refining slag in a fluid condition, and also of removing it after it has taken up impurities from the steel, it is found in practice that very little refining can be done in the simple induction furnace.

In the Röchling-Rodenhauser furnace both legs of the transformer core are provided with primary windings surrounded by induction channels, which are joined in the centre to form a working hearth of ample dimensions. Auxiliary heating is accomplished by means of a secondary winding connected to pole plates which are embedded in the sides of the hearth.

Arc furnaces may be subdivided into radiation furnaces and conduction furnaces, the difference between them being that in the former the arc is struck between the ends of the elec-

trodes themselves and the heat so produced is radiated on to the charge underneath, whilst in the latter the arc is struck between the ends of one or more electrodes and the charge itself.

The main furnace of the former class is the Stassano furnace. This was first developed in Italy, and is employed for steel melting in small sizes. Another furnace belonging to this class is the Rennerfelt furnace, in which three electrodes are used with two-phase current. Two horizontal electrodes, each carrying a separate phase, enter the ends of the furnace; a vertical electrode through the centre of the roof acts as a neutral return common to both phases. It is claimed that the arc in this case is deflected downwards on to the metal charge, which is thereby enabled to utilise the heat of the arc somewhat more efficiently than the Stassano furnace.

Coming now to the second and more important class of arc furnace, the earliest of these furnaces was the Héroult furnace. The current enters by one of two upper electrodes, passes first through the arc gap, then along the surface of the metal, and back by means of the other electrode to the generator. It has the important drawback of requiring single-phase current. Latterly, a three-phase Héroult furnace has been introduced suitable for construction in the larger sizes. The

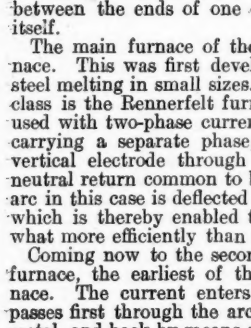


FIG. 1

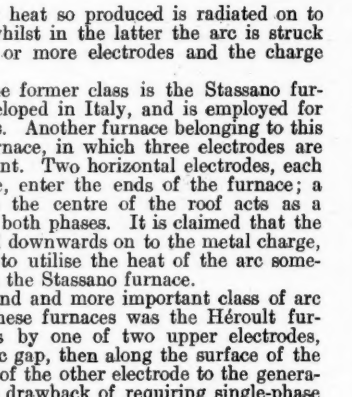


FIG. 2.

Héroult furnace has the disadvantage of surface heating. In other words, the upper layers of the charge are always much hotter than the lower, and this is undesirable when making high-quality steels requiring considerable quantities of ferro-alloys, as these sink to the lower portions of the furnace, where they melt only with difficulty.

The Girod furnace is typical of the second class of arc conduction furnaces. There are one or more vertical electrodes according to the size of furnace and of like polarity. Embedded in the bottom and forming an integral part of the furnace are water-cooled steel studs, which project slightly above the bottom of the hearth and make contact with the charge itself, and so convey the current back to the generator.

Although this arrangement of steel studs in the furnace bottom is essential to the Girod system, it has its disadvantages, and in order to overcome these and at the same time obtain a furnace which will work from the usual supply mains through static transformers, the Electro-Metals furnace was designed a few years ago. The original inventors were the three Swedish engineers, Messrs. Grönwall, Lindblad, and Stälhane, who have designed and developed the Elektrometall shaft furnaces for the reduction of iron ores which have proved such a great success in Sweden. The development of their steel furnace has taken place mainly in this country where, after considerable time spent in experimenting, the furnace has now been thoroughly established for commercial working. Fig. 1 shows the main principles of the furnace.* Two-phase low-pressure current is employed, and this is obtained from a three-phase system through two single-phase transformers using the well-known Scott connection. There are two upper electrodes each carrying a separate phase, whilst in the bottom of the furnace beneath the basic lining is a third electrode which acts as a neutral return common to both phases. Thus the current flows, on each phase, starting from the transformer, along the copper leads to one of the upper electrodes, through this, across the arc gap, through the metallic charge, and thence through the basic lining to the bottom electrode, which consists of a layer of special carbon mixture covering the bottom of the furnace where connections are made to the neutral return leads, which are common to both transformers.

The electrical arrangement of the furnace is shown in fig. 2. The high-pressure supply, assumed in this case to be three-phase, is taken to an isolating switch inside the high-pressure cubicle, and from this it is divided into two circuits, each of which passes to a suitable oil switch, arranged with auxiliary contacts for charging resistances, to neutralise the effect of any sudden loads on switching in. It is found in practice that a fairly high pressure, say 80 volts, gives the best results during the melting stage, but that as much less power is required for the subsequent refining a lower pressure is desirable, as this gives much less wear and tear on the furnace roof and sides, especially during the latter stages of the process. In order to have these two pressures at the ready command of the operator, the switches mentioned above are connected to tappings on the high-pressure side of the transformers, one tapping to give a high pressure of say 80 volts and the other to give about 50 volts. These two switches are interlocked so that only one of them can be put in at one time, and the change from the high to the low pressure is made simply by tripping one switch and then moving along the interlocking bar and putting in the other switch.

As is the case in all arc furnaces, the current flowing in the furnace is controlled by raising and lowering the electrodes. In small furnaces this adjustment is made by hand, but in the larger ones where the moving portion of the electrode and holders, etc., weighs several hundred pounds a motor has to be used, in conjunction with some form of automatic regulator, preferably of the Thury type. In addition, a direct control is effected by tramway-type controllers, which in conjunction with speed regulators enable the electrodes to be quickly hoisted out of, or lowered into, the furnace.

Some of the difficulties which designers have to meet in electric furnace work are only brought out clearly by a consideration of the actual work that has to be done in the furnace itself. Assuming that the previous charge has been "teemed" and the furnace fettled, the cold scrap is thrown into the furnace hearth. This scrap, preferably of steel or wrought iron, is usually of very common quality and contains up to 0.1 per cent. of both sulphur and phosphorus. When the furnace is charged the current is switched on and the electrodes are lowered until an arc is struck between them and the upper portion of the charge. The automatic regulators are then switched on and set to give the required current. In the case of a four-ton furnace, the melting current is about 5,500 amperes, at 75 volts on each phase. The heat of the arc soon melts a large hole in the charge underneath and round each electrode, which continues to travel down as these holes become deeper until a bath of fluid metal is formed in the bottom of the furnace. This bath increases in depth as other portions of the charge melt into it, and the electrodes gradually rise with the level of the metal. By the time they have risen to the usual working level of the bath any unmelted portions of the charge are detached from the sides and pushed within the hot metal in the centre. During the melting the slag is added, consisting of a mixture of lime, fluorspar, sand, and either iron ore or hammer scale. This slag floats on the molten metal, and the chemical actions of refining take place. The carbon in the scrap is oxidised by the iron oxide in the slag, and is given off in the form of carbon monoxide, which rising through the metal gives the appearance of boiling.

This boiling serves to bring the slag and metal into more intimate contact. The silicon and manganese in the scrap are oxidised, and their respective oxides dissolve in the slag. The phosphorus is oxidised and, in the presence of the lime in the oxidising slag, is formed into a phosphate of lime, which enters into the slag. A portion of the sulphur is also oxidised and passes away as a gas. When sufficient time for these reactions to take place has elapsed, the current is switched off and the furnace tilted backwards until most of the slag has run off through a small spout at the back of the furnace into a slag bogie. The remaining portions of the slag are pulled off by means of rabbles until the surface of the metal is practically free from slag. In this way phosphorus is removed. The recarburising additions are made to give the required carbon to the steel and another purifying slag is added. This consists of lime, sand, and fluorspar, and quickly melts when the current is switched on. The pressure is now reduced by changing over from one switch to the other, and the current at the same time is lowered to about 2,000 amperes. The phosphorus as stated above has been removed, but there remains among the injurious constituents in the metal the bulk of the sulphur and in addition a certain amount of oxide of iron which has come from the oxidisation of the scrap during the melting and from the oxidising slag that is necessary for the removal of the phosphorus. The metal must thus be freed from this oxide and from the sulphur. The oxide of iron in the metal is also soluble in this new slag, which takes it up until the solvent powers of the two fluids are equal. The oxide is then removed from the slag by means of the addition of finely-divided carbon in the form of powdered anthracite, which reduces the oxide of iron in the slag and at the same time makes a reducing atmosphere of carbon monoxide inside the furnace. In these circumstances the oxide of iron in the steel is continually passing into the slag as the carbon reduces it, and in this way the whole of the metal is gradually freed from its oxide. At the same time, under the reducing conditions and under the influence of the chemical composition of the slag, the whole of the sulphur is automatically removed from the metal into the slag. In this way the metal is purified into high-grade steel.

The steel being now purified is adjusted to what is required, by means of additions of alloys, the quantity of which is based on the result of a test analysis taken from the bath during the refining. A small addition of aluminium or an alloy of aluminium is usually added at the end in order to remove any trace of gases which may remain in the steel.

The ladle is brought under the tapping spout of the furnace, the small door above this is opened, and the furnace is tilted right over and its contents emptied into the ladle, from which it is teemed into the ingots or castings.

When deciding on which type of furnace to install, the ques-

* The Electro-Metals furnace was fully described in the ELECTRICAL REVIEW of July 25th, 1913.—EDS.

tions of the initial cost of the plant, its suitability for running off existing power supplies, the cost of repairs to the furnace, and the ease with which these can be carried out are as important as the question of low power consumption. Much depends on the kind of raw materials used, upon the process employed, and upon the quality which is desired in the final product. Mild steel suitable for steel castings can be produced much more cheaply than the highest qualities of tool and alloy steels. When melting cold scrap, using two slags, and refining to a first-class quality, the approximate energy consumption decreases from 850 KW.-hours per ton, in the case of a two-ton furnace, to 700 KW.-hours per ton in the case of a five-ton furnace.

In addition to the melting of cold materials, electric furnaces are largely used for refining fluid metal taken from open-hearth furnaces or Bessemer converters, this practice being more common in America and on the Continent than it is in this country. In America there is a big field open for the electric furnace in the manufacture of even such common material as steel rails. The specifications are continually becoming more severe, whilst the ores of the Lake Superior region are gradually becoming more impure; the steel made from them in the acid Bessemer vessels is gradually getting richer in phosphorus, so that a point has been reached when some purification will have to be made in order that the rails shall be capable of fulfilling the required tests. It is of interest to note that several thousand tons of electric steel rails have been in service on some of the main lines in America for some years and have up to the present given excellent results. The process of refining fluid metal is very similar to that employed in the ordinary way after the charge has become melted. A dephosphorising slag is added to the metal as soon as it is poured into the furnace, the finishing slag is added, and the process carried out in exactly the same way as that described earlier in this paper.

The electric furnace is also finding a field as an auxiliary to the open-hearth and Bessemer processes, being used to melt ferro-manganese additions, as it has been found that the saving in the amount of this alloy required more than pays for the cost of melting it electrically.

In this country the field for the electric steel furnace is mainly in the manufacture of tool and alloy steels, for making the smaller sizes of steel castings, and possibly in connection with the open-hearth and Bessemer plants for producing a superior product. Abroad, however, especially in those regions where water power is plentiful and electrical energy can be produced very cheaply, it is possible, in fact probable, that electric furnaces will be used to produce steel in large quantities instead of employing the older class of fuel-fired furnaces.

Discussion.

Mr. J. S. Peck said that the Electro-Metals furnace seemed to have a distinct advantage because it could be made for three-phase working down to comparatively small sizes, whereas the Héroult and other furnaces used three-phase for the large sizes only. Transformers of very special design were required for this work, on account of the number of low-tension coils in parallel to take the very high current. Tappings were also necessary from the high-tension winding in order to vary the voltage on the furnace. If these tappings were taken out in the ordinary way from part of the high-tension winding, there would be an unsymmetrical relation between primary and secondary, and very heavy local currents would probably occur. This difficulty could be overcome, and in general it was necessary to keep the positions of primary and secondary as symmetrical as possible. He asked a number of questions regarding the construction and use of electric furnaces.

Mr. K. M. Faye-Hansen considered the induction furnace the best type from the engineer's point of view; it was possible to make a Kjellin three-phase and arrange it so as to secure a fairly reasonable power factor in reasonable sizes. The steel makers looked at the problem from other points of view, and most of the commercial electric steel furnaces were on the arc principle. Regarding arc furnaces, the first consideration was to get a fairly steady load and a reasonably good power factor. These requirements acted against one another. For instance, a power factor of .97 would be reasonable, using a transformer with leads having very little induction, but immediately a short circuit occurred very heavy currents would flow and cause trouble with the supply company. Small furnaces admitted of power factors of, say, 90 per cent. with short-circuit currents not exceeding double full load, but with large furnaces it was not possible to obtain high power factors on account of the high induction effects. The manufacturer therefore arrived at certain limits of size dependent upon the voltage permissible at the arc.

Mr. D. S. Paxton remarked that the author had recommended the Thury regulator; in his experience some of the other types were quicker in action in the case of large current variation.

Mr. Eustace Thomas spoke of the difficulty of obtaining steel of a particular quality in this country, whilst on the Continent higher grades were produced. One predominant feature, even with English firms of the highest repute, was their inability to reproduce the same steel at different times. A sample, not specially selected, but giving excellent results, might be obtained from the makers, but when the bulk was supplied, it might be totally different. Chemical and microscopical examinations seemed unable to reveal any difference, and it might be said that electrical tests had apparently proved far more searching than any chemical or physical tests which could be applied. Small quantities of impurities such as arsenic or sulphur, which subsequent chemical analysis would scarcely account for, might make an enormous difference. It would appear possible wih the electric furnace to make steel with much greater accuracy than with the ordinary furnace.

Mr. Wilkinson said that he was interested in a supply station in India which included an engineering works and foundry. Many hundred tons of scrap iron were lying useless, and it was considered possible to convert this by means of an electric furnace during the winter nights, when the load was comparatively small. An electric furnace might, in this case, be an ideal adjunct, and profitable to both departments.

Mr. G. L. Rosser asked whether only basic steel was manufactured in the electric furnace, and, if so, whether it was superior to that produced by the Siemens open-hearth acid process.

Mr. J. A. Panton wrote to say that some nine months ago he visited, at Sherbrooke, Canada, a works where electric furnaces were entirely used for smelting ordinary steel and manganese steel castings, including electrically smelted bronze bearings and ferro-manganese brake blocks, all for railway and tramway use. The type of plant in use was similar to the Héroult described by the author, but of the three-phase type, wherein the three vertical carbons were raised or lowered by hand gear into the square steel case, which was lined with special bricks, dipped in tar, and was mounted on curved rails for tilting purposes; the tilting was effected by hand power, and water cooling was provided round the electrode holes. The electrodes were 7 in. in diameter and about 3 ft. long, screwed male and female for continuous feeding. This represented a two-ton furnace, which invariably received a charge of 35-30 cwt. of metal. The power was supplied by a waterfall seven miles distant, arriving at the works at 6,600 volts, which was transformed down to 110 volts. The time taken for a cold charge was five hours, but as the plant invariably worked night and day the remaining heats took four to four and a quarter hours. The starting current represented 264 KW., or 2,400 amperes melting current on the low side, so that for a four hours' charge the consumption was about 900 KW.-hours for 30 cwt. of metal in the ladle; the cost per unit was 0.2 of a cent, contracting for large blocks of power annually. The chief difference between the castings made by the new and old processes was that owing to the low carbon in electric castings, many were used without annealing. He agreed with the author that a very fine field existed for electric steel rails, especially of the manganese or ferro-manganese type. Caution should be exercised not to reduce the conductivity of rails used for electric railway and tramway purposes, and with regard to tramways where magnetic slipper brakes were in use, manganese steel made by the electric process was practically non-magnetic, more so than manganese steel made by the ordinary process.

The Author, in reply, said that makers in the early days of electric furnaces had experienced a lot of trouble at the works of their customers, who expected immediate commercial results. This led to a deal of prejudice against the electric furnace; but now, fortunately, the prejudice was being overcome and furnaces were working steadily and continuously on sound lines. Fifteen-ton furnaces had been used in America, chiefly for refining metal for steel rails. Tests were now in progress with rails produced in this way, and there was every indication that the results would be very satisfactory. A big development was to be expected in the United States in the use of large electric furnaces for refining crude Bessemer steel. The largest electric furnace known to the author was a Girod furnace of 20-ton capacity installed in France prior to the war. The subject of ore reduction by electricity was treated in reports published at various times in Sweden, which possessed favourable conditions in the form of reasonably cheap power and suitable ore. At the present time Sweden had electric furnaces either working or being installed with a total capacity of 40,000 H.P. The price at which electricity would permit economical working depended upon the quality of the product required. Generally speaking, with energy at ½d. or .6d. per KW.-hour the electric furnace would compete in the small steel casting industry. It would certainly do so for high-grade tool steels. The heat in the induction furnace was generated within the metal comprising the ring round the transformer, consequently the slag which rested on the top of the metal received its heat from the latter. This condition, together with exposure to the atmosphere, caused the slag to be cooler than the metal during the whole process, and for this reason certain slags which would otherwise be suitable could not be employed. In the arc furnace the conditions were reversed, as the arc played on the slag, which in turn delivered heat to the metal. This condition ensured proper chemical reaction in steel refining. The power factor in large induction furnaces was very bad and specially low frequencies had to be employed. A two-phase furnace would not be likely to suffer from shorts on both phases at once, so that the total disturbance was reduced. The short circuits occurred during melting, when the metal became soft and fell against the electrode, and the usual procedure was to raise the electrode out of the way when this occurred. It was necessary to have the current passing through the bottom of the two-phase Electro-Metals furnace during the whole period. This

manifested itself in the refining stages, as in the later stages the circulation of the metal avoided inequalities in temperature of the metal. A modification of the two-phase furnace was to be introduced whereby the amount of current flowing in the bottom of the furnace would be under control. The Continental steel referred to by Mr. Thomas was probably electric steel, and very regular and uniform in quality. In the author's opinion the trouble with crucible steel was the fact that the crucibles themselves contained a small quantity of steel, and no two crucibles would smelt out exactly alike. In consequence, there was much more danger of variation than in the case of the electric furnace, where the sole charge was of uniform quality. The chief advantage of electric steel was that the injurious oxide of iron which was present in all molten steel could be effectively removed, owing to the reducing conditions in electric arc furnaces. In reply to Mr. Wilkinson, with a two-ton furnace the total time between teeming one heat and teeming the second heat would be about six hours. The melting period would be about three hours, during which time the full capacity, say 400 KW., would be taken. The second or refining period would probably take only 200 KW. and would last about two hours. Taking the case of a furnace working continuously, that is to say, 24 hours per day and five days per week, so as to allow for repairs, twenty charges per week of 45 or 50 working weeks per annum would be usual. The power factor depended upon the arrangement of leads, but in the case mentioned it would be about .9. One hour in the six referred to would be allowed for charging, removing slag, etc. The time table quoted would not apply to special tungsten steel, but for refining any scrap and making carbon steel with low sulphur and phosphorous, say .08-.1 per cent. sulphur and phosphorus in the raw material down to .02 per cent. sulphur and the same phosphorus in the finished product. With one or two exceptions all electric steel was made on a basic bottom. Dephosphorising could not be carried out on an acid bottom. The low carbon in electric steel castings was very important, as it admitted of such castings being subsequently machined without annealing. In the case of crucible steel castings, the carbon could not be brought so low, and consequently they were hard and required annealing before machining.

NEW PATENTS APPLIED FOR, 1915.

(NOT YET PUBLISHED).

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

1,148. "Magnetic compasses for night marching, reconnaisance, aviation, and other military and naval purposes." F. O. CREAGH-OSBORNE, A. J. HUGHES and H. HUGHES & SON, LTD. January 25th.

1,157. "Means for the attachment of electric lamps or ceiling roses to ceilings, beams, and the like." W. DAWSON & H. GUNSON. January 25th.

1,158. "Electric fuse or cut-out boxes." W. DAWSON & H. GUNSON. January 25th.

1,173. "Tilting electric furnace for melting and refining metals." F. BASSANESE. January 25th. (Complete.)

1,214. "Electric generators and motors." M. M. CARDELLINO. January 25th. (Complete.)

1,221. "Electric arc-lamp carbon ferrules." T. MOORE. January 26th.

1,234. "Stranded electrical conductors." M. HOCHSTADTER. January 26th. (Convention date, January 28th, 1914, Germany.) (Complete.)

1,240. "Gyrostatic apparatus." J. GRAY & J. GORDON GRAY. January 26th.

1,249. "Microphone specially adapted to receive and to transmit with great intensity the particular sounds for which it is regulated." R. F. BOSSINI. January 26th.

1,275. "Pocket electric flash-lights." W. J. MELLERSH-JACKSON. January 26th. (Samuel Isaac Posen, United States.) (Addition to 18,809/14.) (Complete.)

1,284. "Electrically-controlled feed-operating mechanism." VULKAN MASCHINENFABRIKS. AKT. GES. January 26th. (Convention date, February 2nd, 1914, Germany.) (Complete.)

1,286. "Electrical heating devices." JOH. KREMENEZKY (firm of). January 26th. (Convention date, February 21st, 1914, Austria.) (Complete.)

1,316. "Means for controlling electrical illuminating or advertising devices." W. & T. AVERY, LTD., & R. ROBERT GIBBS. January 27th.

1,328. "Electric switches." H. LUCAS & W. H. EDWARDS. January 27th. (Complete.)

1,340. "Central station generating plant." BRITISH THOMSON-HOUSTON CO., LTD., F. H. CLOUGH & F. SAMUELSON. January 27th.

1,341. "Illuminating apparatus." BRITISH THOMSON-HOUSTON CO., LTD. January 27th. (General Electric Co., United States.)

1,346. "Insulation of telephone cables." K. W. WAGNER. January 27th. (Convention date, January 20th, 1914, Germany.) (Complete.)

1,369. "Electric lamps for use on bicycles and the like." J. J. ROWE. January 27th.

1,376. "Electric ovens." I. T. NEGUS. January 28th. (Divided application on 9,213/14, April 14th.)

1,377. "Electric ovens." I. T. NEGUS. January 28th. (Divided application on 9,213/14, April 14th.)

1,402. "Wireless apparatus." E. R. CLARKE. January 28th.

1,404. "Controlling dynamo-electric machines running at varying speeds." A. W. S. POCKLINGTON & H. F. FOSTER. January 28th.

1,428. "Electrically-propelled motor vehicles." P. A. H. MOSSAY & MOSSAY & Co., LTD. January 28th.

1,435. "Dynamo-electric machines and electrical systems connected therewith." J. STONE & Co., LTD., and A. H. DARKER. January 28th.

1,453. "Mercury globule electrical contact-maker for releasing mine winding signal indicators, actuating indicators of the stopping, starting, and reductions of speed of machinery and the like." G. SAINT. January 29th. (Complete.)

1,468. "Starting electrodes for vapour electric devices." F. CONRAD. January 29th. (Convention date, January 30th, 1914, United States.) (Complete.)

1,470. "Automatic and semi-automatic telephone systems." BETULANDER AUTOMATIC TELEPHONE CO., LTD., & W. AITKEN. January 29th.

1,471. "Automatic and semi-automatic telephone systems." BETULANDER AUTOMATIC TELEPHONE CO., LTD., & W. AITKEN. January 29th.

1,472. "Semi-automatic telephone systems." BETULANDER AUTOMATIC TELEPHONE CO., LTD., & W. AITKEN. January 29th.

1,480. "Manufacture and use of luminous radiations for therapeutical purposes." W. S. SIMPSON. January 29th.

1,483. "Intergrating electric wattmeters." J. HIKELEY. January 29th.

1,500. "Lamp supports and casing, particularly designed for use with electric incandescent lamps." B. J. GRIGSBY. January 29th.

1,507. "Chocks or apparatus for the shaping of pottery." F. HANCOCK. January 29th.

1,520. "Miners' electric safety lamps." C. H. ELLIOTT & G. BARSTOW. January 30th.

1,522. "Telautograph apparatus." A. MONTGOMERY LOW. January 30th.

1,525. "Construction of electric batteries. H. F. JOEL. January 30th.

1,530. "Electric batteries." B. PORDES. January 30th. (Complete.)

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of MESSRS. W. P. THOMPSON & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1913.

21,525. SOUND-REPRODUCING APPARATUS. W. H. Derriman (Automatic Enunciator Co.). September 24th.

24,422. SOCKETS FOR ELECTRIC INCANDESCENT LAMPS. C. A. Vetter. October 28th.

27,542. APPARATUS FOR USE IN CONNECTION WITH THE ELECTRIC LIGHTING OF AUTOMOBILES. F. E. Wilson. November 29th.

28,838. TELEPHONE OR LIKE INSTRUMENTS. W. H. Derriman (Automatic Enunciator Co.). December 13th.

29,366. LIMIT SWITCHES EMPLOYED TO CONTROL THE MOVEMENTS OF ELECTRICALLY-OPERATED CRANES, HOISTS, FREIGHT AND PASSENGER ELEVATORS, WINCHES, TURNTABLES, AND THE LIKE. Craven Brothers, Ltd., F. Garner, & A. E. Horrocks. December 20th.

1914.

123. ELECTRIC ACCUMULATOR CELLS. Svenska Ackumulator Aktiebolaget Jungner. January 2nd. (January 16th, 1913.)

415. CLOCKWORK MECHANISM FOR CONTROLLING GAS VALVES, ELECTRIC SWITCHES, AND THE LIKE. E. H. Horstmann, G. O. H. Horstmann, A. Horstmann, S. A. Horstmann, & W. T. Edgar. January 7th.

590. ELECTRIC RESISTANCES. G. Mascarini & A. Contardi. January 8th. (January 11th, 1913.)

796. AUTOMATIC PRINTING REGISTER FOR SHIPS' ENGINE-ROOM AND BRIDGE TELEGRAPH. T. Nicholson & L. R. Barron. January 12th.

815. ELECTRIC RESISTANCES. H. Snowdon. January 12th.

816. METHOD OF OPERATING OR ACTUATING AUDIBLE ALARMS. E. V. Gratze. January 12th.

1,008. ELECTRIC SWITCH. A. C. Greene. January 14th.

1,341. DYNAMO-ELECTRIC MACHINES. A. H. Midgley & C. A. Vandervell. January 17th.

1,556. CONTROL OF MOVING BODIES BY RADIANT ENERGY. J. H. Hammond, Jun. January 20th. (Convention date not granted.)

1,587. BONDING DEVICES FOR ELECTRICAL CONDUIT SYSTEMS. D. L. J. Broadbent. January 21st. (Cognate application 6,811/14.)

3,192. RADIO-TELEGRAPHIC STATIONS. E. Girardeau. February 6th. (February 17th, 1913.)

3,217. LOCKS FOR HANDLES FOR CONTROLLERS AND THE LIKE. British Thomson-Houston Co. (General Electric Co.). February 6th.

4,473. "Device for controlling the frequency of automatic intermittently-operated lighting apparatus." AKTIEBOLAGET LUX. February 20th. (February 22nd, 1913.

5,456. ELECTRIC INCANDESCENT LAMPS. British Thomson-Houston Co. (General Electric Co.). March 3rd.

6,652. COMPOSITE TROLLEY WHEELS. E. M. Taunton & Electro-Mechanical Brake Co. March 16th.

7,145. HEATING ELEMENTS OF ELECTRIC STOVES AND THE LIKE. O. C. Hawkes. March 21st.

8,263. TOOTHED WHEELS. British Thomson-Houston Co. (General Electric Co.). April 1st.

9,046. PRODUCTION OF ULTRA-VIOLET RAYS. J. Von Kowalski-Wierusz. April 9th.

9,367. METHODS OF COATING METALS WITH ZINC AND APPARATUS THEREFOR. British Thomson-Houston Co. (General Electric Co.). April 15th.

10,364. PERFORATED-TAPE CONTROLLED AUTOMATIC IMPULSE TRANSMITTERS. H. Pfannenstiehl. April 27th. (April 29th, 1913.)

11,084. TRANSPORT OF ELECTRIC SEARCHLIGHTS OR PROJECTORS. Soc. Anon. des Automobiles & Cycles Peugeot. May 5th. (May 6th, 1913.)

11,326. DEVICES FOR MAINTAINING OSCILLATING MOVEMENTS OF SUBMARINE MINES AND LIKE FLOATING BODIES BETWEEN CERTAIN LEVELS. T. Carlander. May 7th. (May 28th, 1913.)

11,355. POINTS FOR TRAMWAYS, RAILWAYS, AND THE LIKE. Edgar Allen & Co. & E. Larmuth. May 8th.

11,564. ELECTRIC IMPULSE TRANSMITTING DEVICE. E. C. R. Marks (Canadian Independent Telephone Co.). May 11th.

12,005. ELECTRIC-IGNITION PLUGS FOR INTERNAL-COMBUSTION ENGINES. D. Roberts. May 15th.

12,656. TELEPHONE SET. P. L. Jensen & E. S. Pridham. May 22nd.

13,018. TELEGRAPH RECEIVER AND KEYBOARD TELEGRAPH TRANSMITTER. E. J. Kessels. May 27th. (Addition to 21,332/12 and 3,582/13.)

14,098. CURRENT COLLECTORS FOR ELECTRIC TRAMWAYS. Compagnie Générale des Omnibus de Paris. June 11th. (June 13th, 1913.)

14,358. MEANS FOR CONVEYING ARTICLES THROUGH THE BATH OF AN ELECTROPLATING OR OTHER APPARATUS. C. K. Mills (Hanson & Van Winkle Co.). June 15th.

14,567. MEANS FOR TRANSMITTING ROTARY MOTION. Jandus Arc Lamp & Electric Co., and A. Denman-Jones. June 17th.

15,456. ELECTRODES FOR ELECTRIC FURNACES. F. J. Machalske. June 27th. (June 27th, 1913.)

17,038. SYSTEMS AND METHODS OF ELECTRIC MOTOR CONTROL. L. G. Riley. July 17th. (October 3rd, 1913.)

18,378. COMPASSES FOR USE ON BOARD SHIP OR ON AEROPLANES OR FOR OTHER PURPOSES. W. D. Whyte. August 7th.

21,966. MAGNETO-ELECTRIC GENERATORS FOR IGNITION PURPOSES. C. T. Mason. November 3rd. (Divided application from 29,655/13, December 23rd.)